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VALIDATION OF GENERALIZED CUSHIONING MODELS FOR SELECTED TEMPER--ETC(U)  
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1 of 2  
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VALIDATION OF GENERALIZED  
CUSHIONING MODELS FOR SELECTED TEMPERATURE  
SENSITIVE CUSHIONING MATERIALS

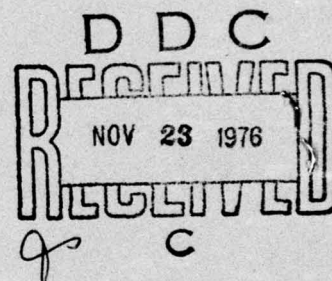
by

Richard M. Wyskida  
James D. Johannes

Final Report

For the Period 24 October 1975 - 23 October 1976

Vol. I

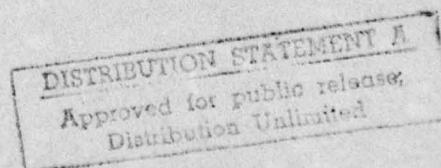


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School of Graduate Studies and Research ✓  
The University of Alabama in Huntsville  
P. O. Box 1247  
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October 1976





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Vol. II: This report presents detailed instructions for the use of the five models validated in Vol. I. In particular, all five models can be utilized for cushion encapsulation (ENCAP) or for cushion optimization (CUSHOP). Sample problems are included for each of the developed models.

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6  
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CUSHIONING MODELS FOR SELECTED TEMPERATURE  
SENSITIVE CUSHIONING MATERIALS.

Volume I.

by

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Richard M. Wyskida  
James D. Johannes

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Final Report.

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## INTRODUCTION

Previous container cushioning research reports [1,2 3,4,5], prepared under the MICOM container cushioning research effort, have been concerned with 1) the acquisition of an experimental data base for selected bulk cushioning materials over a wide range of temperatures, 2) the development of a statistically significant parabolic-logrithmic equation for a specific set of conditions, and 3) the development of confidence intervals and prediction limits for selected temperature sensitive cushioning materials.

McDaniel [6] developed and validated the original model for the Minicel cushioning material. The results of [5] were not available at the time of McDaniels' validation of the Minicel model. Extensive drop test data was required for the Minicel model validation, in addition to the basic data required for the model development.

This research report utilizes the results of previous container cushioning research efforts [1,2,3,4,5] in the development of a validation procedure for the various cushioning material models being developed. The following cushioning materials were considered in this research effort: 1) Minicel - 2 lbs./ft.<sup>3</sup>, 2) Ethafoam - 2 lbs./ft.<sup>3</sup>, 3) Ethafoam - 4 lbs./ft.<sup>3</sup>, 4) Polyester Urethane - 4 lbs./ft.<sup>3</sup>, and 5) Polyether Urethane - 3 lbs./ft.<sup>3</sup>.

This volume is divided into five major sections, one associated with each material investigated. Each section contains the basic mathematical model appropriate for the material under consideration, together with selected examples of

the validation combinations requiring specific explanation. In the case of Minicel, the entire set of validation combinations is included. However, for the remaining materials, only selected examples are included.

SECTION I  
MINICEL POLYETHYLENE FOAM  
(2 Lb./Ft.<sup>3</sup>)



## MINICEL MODEL VALIDATION

The data base for the superimposed dynamic cushioning curves originally reported upon in [1] was utilized by McDaniel [6] in the development of a generalized model for the Minicel material. McDaniel then conducted additional drop tests on the Minicel material at 1) a 21 inch drop height on 1, 2, and 3 inch thick samples, and 2) on 4 and 5 inch thick samples at drop heights of 12, 18, 24, and 30 inches. Utilizing a test of means, and a test of variances, McDaniel statistically validated the general model within the data base established.

The McDaniel validation method is both costly and time consuming since additional drop testing is required. However, it was the only method available at that time to validate the model. Consequently, a search was initiated to develop a more efficient and effective validation procedure which, hopefully, would not require additional drop testing.

It should be recalled that the Minicel model consists of a constant plus 24 terms of the polynomial of the general form:

$$G = C_o + \sum_{\ell=0}^1 h^{\ell/2} \sum_{k=0}^1 \frac{1}{T^{(1/2+k)}} \sum_{j=1}^3 \theta^j \sum_{i=0}^2 C_{ijk\ell} (\ln \sigma_s)^i$$

where:

$C_o$  = model constant

$h$  = drop height in inches

$T$  = thickness of cushion in inches

$\theta$  = temperature in  $\frac{^{\circ}\text{F}+460}{100}$

$\sigma_s$  = static stress in psi times 100

$C_{ijk\ell}$  = model variable coefficient.

The actual model for Minicel is shown in Table 1. Since the Minicel model was already validated, it was decided that any new validation procedure should be tested on this model.

MICOM Report No. RL-CR-76-3 [5] developed a procedure for determining confidence intervals and prediction limits on dynamic cushioning curves of the form:

$$\hat{y}_i = b_0 + b_1 \ln x_i + b_2 (\ln x_i)^2$$

where:

$\hat{y}_i$  = predicted deceleration at impact experienced by the packaged item for a given cushion thickness, density, drop height, and temperature,

$x_i$  = 100 times the static stress experienced by the cushion from the face of the packaged item, and

$b_0, b_1, b_2$  = model coefficients.

Since the developed procedure, referenced above, was proven successful for individual dynamic cushioning curves, it was hypothesized that this procedure could be modified for the generalized model. The general theory documented in [5] remains the same.

Recall that MICOM Report No. RL-CR-75-1 [1] developed a statistical procedure which resulted in individual dynamic cushioning curves, 35 out of 36 being statistically significant at an alpha level of .05. Therefore, any generalized procedure for model validation should be compared with these individual dynamic cushioning curves. Also, several comparisons were presented in [5] illustrating the applicability of the procedure with MIL-HDBK-304A [7] cushioning curves.

TABLE 1  
MINICEL MODEL

Variable	Coefficient	$\theta$	$\theta^2$	$\theta^3$	$h^{1/2}$	$T^{-1/2}$	$T^{-3/2}$	$(\ln \sigma_s)$	$(\ln \sigma_s)^2$
0	-8.3931602								
1	0.0	X				X			
2	0.0	X				X		X	
3	3.5419457	X				X			X
4	0.0	X			X		X		
5	-15.318724	X			X		X	X	
6	3.340187	X			X		X		X
7	207.49326	X			X	X			
8	-50.359565	X			X	X		X	
9	1.4344456	X			X	X			X
10	0.0		X			X			
11	-6.6956791		X			X		X	
12	0.0		X			X			X
13	0.0		X		X		X		
14	0.0		X		X		X	X	
15	0.0		X		X		X		X
16	-54.656667		X		X	X			
17	11.621323		X		X	X		X	
18	0.0		X		X	X			X
19	-1.3016393			X		X			
20	2.0789886			X		X		X	
21	-0.226642			X		X			X
22	-0.40141035			X	X		X		
23	0.61173036			X	X		X	X	
24	-0.0953190			X	X		X		X
25	3.9422841			X	X	X			
26	-0.8660377			X	X	X		X	
27	0.0			X	X	X			X
28	-233.77506	X					X		
29	28.363456	X					X	X	
30	0.0	X					X		X
31	49.67875		X				X		
32	26.32324		X				X	X	
33	-6.0678372		X				X		X
34	0.0			X			X		
35	-6.1520847			X			X	X	
36	1.0752888			X			X		X



Consequently, it was hypothesized that the generalized model developed by McDaniel, which provides dynamic cushioning curves for individual combinations of drop height, temperature, static stress, and cushion thickness, together with the prediction limit equation from [5],

$$\hat{y} \pm \frac{t_{\alpha}}{2} s \sqrt{1 + \mathbf{T}(\mathbf{x} \mathbf{T} \mathbf{x})^{-1} \mathbf{a}}$$

where

$$\hat{y} = b_0 + b_1 \ln x + b_2 (\ln x)^2,$$

would be combined to provide prediction limits for the Minicel model at selected static stress levels, drop heights, temperatures, and cushion thickness. The individual dynamic cushioning curves [IDCC] developed in [1] would be compared with the developed prediction limits to ascertain whether the generalized model was predicting the IDCC in a consistent statistical fashion. In essence, the test of the generalized model is to determine if it can provide G-level values which include the significant static stress level portion of the IDCC and remain within the prediction limits for the particular conditions under consideration. For the purposes of this validation study, the significant portion of the IDCC are identified as the minimum IDCC G-level value bounded by  $\pm 1.0$  psi. This significant portion may be truncated at the lower or upper static stress level if the bounds fall outside the standard static stress range of 0.05 to 5.20 psi. For example, from page 10, it is apparent that the minimum G-level for the IDCC is 34.38 G's at a static stress of 1.2 psi. Placing  $\pm 1.0$  psi bounds on the identified static stress level gives a static stress range of .20 psi to 2.20 psi. This valid range is identified in pages 10 through 45 as a double asterisk (\*\*) to the left of the MODEL column. Over this

static stress range, it is seen that all model values are contained within the developed prediction limits for this case.

Page 12 presents the first variation from the established format of page 10. For the static stress range of .90 to 4.80 psi, the lower prediction values are identified as --. This notation indicates that the true calculated mathematical value for a particular lower prediction limit value is negative. Since a negative G value is meaningless for this study, the actual negative values are not shown, but are assumed to be zero.

Referring to page 16, it is noted that an inconsistency appears to exist. Immediately to the right of the values in the column entitled MODEL are seen several asterisk. These asterisk indicate the static stress levels at which the model values are outside of the IDCC prediction limits. For the IDCC, the minimum G's are 39.78 at a static stress of .40 psi. The lower static stress level of .05 psi is utilized as the lower bound since it is the smallest static stress level on which drop test data is available. The upper bound becomes 1.40 psi. The comparison between the identified static stress range (indicated with double asterisk) and the model predicted values outside of the prediction limit (single asterisk), identifies the only combination of drop height, temperature, and cushion thickness, out of 36 combinations tested, that failed the validation procedure. This is extremely noteworthy, since the entire bulk cushioning material research effort has been conducted at a statistical level of  $\alpha = .05$ . Hence, we would expect, from a statistical viewpoint, to find at least one out of 36 tested cases which is not validated. From the positive viewpoint, we find 27 of the 36 tested cases were within the prediction limits for the entire static stress range (.05 to 5.20 psi) over which data was available.

Consequently, it is felt that the prediction limit approach to cushioning model validation is in agreement with the approach of McDaniel. Furthermore, this approach does not require any additional drop testing, but instead, a small amount of computer time. The developed computer code necessary to utilize this validation procedure is contained in the Appendix. This procedure will be utilized to validate the mathematical bulk cushioning models for the remaining materials identified earlier in this report.

MINICEL

12.0 IN. D.H.

1.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION (G)

LOWER-P

MODEL

UPPER-P

.05	186.72	156.91		193.03	216.52
.10	128.03	98.70		128.64	157.37
.15	100.29	71.42		98.36	129.17
.20	83.55	55.12	**	80.19	111.98
.25	72.26	44.26	**	67.99	100.25
.30	64.12	36.55	**	59.24	91.69
.35	58.00	30.85	**	52.71	85.16
.40	53.28	26.52	**	47.69	80.03
.45	49.54	23.18	**	43.76	75.91
.50	46.55	20.56	**	40.63	72.53
.55	44.12	18.51	**	38.11	69.74
.60	42.15	16.89	**	36.08	67.41
.65	40.52	15.61	**	34.43	65.44
.70	39.19	14.61	**	33.10	63.77
.75	38.09	13.84	**	32.02	62.35
.80	37.20	13.25	**	31.15	61.14
.85	36.47	12.82	**	30.46	60.11
.90	35.88	12.52	**	29.93	59.23
.95	35.41	12.33	**	29.52	58.49
1.00	35.04	12.23	**	29.22	57.86
1.20	34.38	12.52	**	28.87	56.23
1.40	34.58	13.52	**	29.44	55.63
1.60	35.32	14.91	**	30.56	55.74
1.80	36.41	16.50	**	32.05	56.33
2.00	37.74	18.20	**	33.77	57.28
2.20	39.22	19.95	**	35.64	58.49
2.40	40.81	21.71		37.61	59.90
2.60	42.46	23.48		39.65	61.45
2.80	44.17	25.24		41.73	63.09
3.00	45.90	27.00		43.82	64.80
3.20	47.65	28.75		45.93	66.54
3.40	49.40	30.50		48.03	68.30
3.60	51.15	32.24		50.12	70.06
3.80	52.90	33.99		52.20	71.81
4.00	54.63	35.74		54.27	73.53
4.20	56.36	37.49		56.31	75.23
4.40	58.07	39.25		58.33	76.89
4.60	59.76	40.99		60.33	78.53
4.80	61.44	42.74		62.31	80.14
5.00	63.10	44.46		64.26	81.73
5.20	64.74	46.16		66.19	83.31



MINICEL

12.0 IN. D.H.

2.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	187.89	171.39	182.95	204.39
.10	129.88	113.62	124.56	146.14
.15	101.39	85.37	96.12	117.41
.20	83.61	67.83	78.50	99.40
.25	71.22	55.66	66.29	86.78
.30	61.99	46.65	57.26	77.33
.35	54.83	39.70	50.29	69.96
.40	49.09	34.17	44.75	64.01
.45	44.39	29.67	40.23	59.11
.50	40.47	25.94	36.50	55.00
.55	37.17	22.82	33.37	51.51
.60	34.34	20.17	30.71	48.50
.65	31.90	17.91	28.44	45.89
.70	29.79	15.96	26.48	43.61
.75	27.94	14.27	24.79	41.60
.80	26.31	12.80	23.31	39.82
.85	24.88	11.52	22.02	38.23
.90	23.61	10.39	20.89	36.82
.95	22.48	9.40	19.90	35.56
1.00	21.48	8.53	19.03	34.42
1.20	18.43	5.95	** 16.48	30.91
1.40	16.49	4.38	** 14.99	28.60
1.60	15.28	3.46	** 14.19	27.09
1.80	14.57	2.98	** 13.87	26.16
2.00	14.23	2.79	** 13.88	25.66
2.20	14.15	2.82	** 14.13	25.47
2.40	14.27	3.01	** 14.57	25.53
2.60	14.54	3.32	** 15.14	25.77
2.80	14.94	3.73	** 15.81	26.15
3.00	15.43	4.22	** 16.57	26.63
3.20	15.99	4.78	** 17.39	27.20
3.40	16.61	5.39	18.25	27.83
3.60	17.28	6.06	19.16	28.50
3.80	17.98	6.77	20.09	29.20
4.00	18.72	7.52	21.04	29.92
4.20	19.48	8.30	22.01	30.65
4.40	20.25	9.12	22.99	31.39
4.60	21.05	9.95	23.97	32.14
4.80	21.85	10.80	24.97	32.90
5.00	22.66	11.66	25.96	33.67
5.20	23.48	12.52	26.96	34.45

MINICEL

12.0 IN. D.H.

3.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	167.68	143.62	161.15	191.74
.10	115.25	91.57	109.98	138.93
.15	89.42	66.12	84.84	112.73
.20	73.27	50.32	69.15	96.21
.25	61.97	39.37	58.21	84.57
.30	53.54	31.29	50.06	75.80
.35	46.98	25.06	43.73	68.90
.40	41.72	20.12	38.66	63.31
.45	37.39	16.11	34.51	58.68
.50	33.78	12.81	31.05	54.76
.55	30.72	10.04	28.12	51.40
.60	28.10	7.71	25.62	48.49
.65	25.83	5.72	23.46	45.95
.70	23.86	4.02	21.59	43.70
.75	22.13	2.55	19.95	41.71
.80	20.61	1.28	18.51	39.94
.85	19.26	.17	17.24	38.34
.90	18.06	- -	16.11	36.91
.95	16.99	- -	15.11	35.62
1.00	16.03	- -	14.22	34.45
1.20	13.10	- -	11.51	30.74
1.40	11.18	- -	** 9.78	28.18
1.60	9.94	- -	** 8.70	26.41
1.80	9.16	- -	** 8.06	25.24
2.00	8.72	- -	** 7.74	24.50
2.20	8.53	- -	** 7.65	24.09
2.40	8.53	- -	** 7.75	23.95
2.60	8.68	- -	** 7.98	24.00
2.80	8.94	- -	** 8.32	24.21
3.00	9.28	- -	** 8.74	24.54
3.20	9.70	- -	** 9.22	24.96
3.40	10.18	- -	** 9.76	25.44
3.60	10.70	- -	10.34	25.96
3.80	11.26	- -	10.95	26.52
4.00	11.85	- -	11.59	27.10
4.20	12.46	- -	12.25	27.69
4.40	13.10	- -	12.93	28.29
4.60	13.74	- -	13.62	28.89
4.80	14.41	- -	14.32	29.50
5.00	15.08	.03	15.03	30.12
5.20	15.76	.76	15.74	30.75

MINICEL

12.0 IN. D.H.

1.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION (G)	MODEL	UPPER-P
		LOWER-P		
.05	125.19	107.06	** 126.62	143.32
.10	82.32	64.48	** 85.25	100.15
.15	63.67	46.12	** 66.93	81.22
.20	53.32	36.05	** 56.55	70.59
.25	46.94	29.94	** 50.00	63.93
.30	42.79	26.06	** 45.63	59.52
.35	40.03	23.56	** 42.61	56.51
.40	38.20	21.98	** 40.51	54.42
.45	37.01	21.03	** 39.04	52.98
.50	36.28	20.54	** 38.03	52.02
.55	35.90	20.39	** 37.38	51.41
.60	35.78	20.50	** 36.99	51.07
.65	35.87	20.80	** 36.81	50.94
.70	36.11	21.25	** 36.79	50.97
.75	36.48	21.82	** 36.90	51.14
.80	36.95	22.49	** 37.12	51.41
.85	37.50	23.23	** 37.43	51.78
.90	38.12	24.02	** 37.80	52.21
.95	38.79	24.87	** 38.24	52.71
1.00	39.50	25.75	** 38.72	53.26
1.20	42.65	29.50	** 41.01	55.81
1.40	46.07	33.41	** 43.62	58.73
1.60	49.58	37.31	** 46.39	61.84
1.80	53.10	41.15	49.23	65.06
2.00	56.60	44.87	52.07	68.33
2.20	60.03	48.46	54.90	71.60
2.40	63.40	51.94	57.68	74.86
2.60	66.69	55.29	60.42	78.09
2.80	69.90	58.53	63.11	81.26
3.00	73.03	61.67	65.75	84.39
3.20	76.08	64.72	68.32	87.44
3.40	79.06	67.70	70.84	90.42
3.60	81.96	70.59	73.31	93.33
3.80	84.80	73.43	75.72	96.17
4.00	87.57	76.20	78.08	98.93
4.20	90.27	78.92	80.38	101.61
4.40	92.91	81.59	82.64	104.23
4.60	95.49	84.21	84.85	106.77
4.80	98.02	86.77	87.02	109.26
5.00	100.49	89.28	89.14 *	111.69
5.20	102.91	91.74	91.22 *	114.08

MINICEL

12.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	97.50	82.79	** 98.87	112.21
.10	65.82	51.34	** 65.99	80.30
.15	51.01	36.76	** 50.62	65.26
.20	42.16	28.13	** 41.45	56.19
.25	36.25	22.44	** 35.32	50.07
.30	32.04	18.44	** 30.96	45.65
.35	28.91	15.51	** 27.71	42.31
.40	26.52	13.32	** 25.24	39.72
.45	24.66	11.65	** 23.32	37.67
.50	23.19	10.38	** 21.80	36.01
.55	22.02	9.39	** 20.59	34.66
.60	21.09	8.63	** 19.62	33.55
.65	20.34	8.06	** 18.85	32.62
.70	19.74	7.63	** 18.24	31.86
.75	19.27	7.31	** 17.75	31.23
.80	18.90	7.10	** 17.37	30.70
.85	18.61	6.96	** 17.08	30.26
.90	18.40	6.89	** 16.86	29.91
.95	18.25	6.88	** 16.71	29.61
1.00	18.15	6.92	** 16.61	29.38
1.20	18.15	7.40	** 16.63	28.90
1.40	18.59	8.24	** 17.10	28.94
1.60	19.29	9.27	** 17.84	29.32
1.80	20.16	10.39	** 18.75	29.92
2.00	21.12	11.55	** 19.76	30.70
2.20	22.16	12.73	20.85	31.59
2.40	23.24	13.90	21.98	32.58
2.60	24.34	15.07	23.13	33.62
2.80	25.46	16.22	24.30	34.70
3.00	26.58	17.36	25.47	35.80
3.20	27.70	18.49	26.64	36.92
3.40	28.82	19.61	27.81	38.03
3.60	29.93	20.72	28.97	39.14
3.80	31.03	21.82	30.11	40.24
4.00	32.12	22.92	31.25	41.32
4.20	33.19	24.01	32.37	42.38
4.40	34.26	25.09	33.48	43.42
4.60	35.30	26.17	34.58	44.44
4.80	36.34	27.24	35.66	45.44
5.00	37.36	28.29	36.72	46.43
5.20	38.37	29.33	37.77	47.41



MINICEL

12.0 IN. D.H.

3.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	80.86	65.67	82.40	96.06
.10	56.02	41.07	54.56	70.98
.15	44.06	29.34	41.36	58.78
.20	36.73	22.24	33.37	51.22
.25	31.70	17.43	27.96	45.96
.30	28.01	13.96	24.05	42.06
.35	25.20	11.36	21.10	39.03
.40	22.98	9.35	18.81	36.61
.45	21.19	7.76	17.00	34.62
.50	19.73	6.50	15.54	32.97
.55	18.52	5.48	14.35	31.56
.60	17.51	4.64	** 13.38	30.37
.65	16.65	3.97	** 12.57	29.33
.70	15.92	3.41	** 11.90	28.44
.75	15.30	2.96	** 11.35	27.65
.80	14.77	2.59	** 10.90	26.96
.85	14.32	2.29	** 10.52	26.35
.90	13.93	2.05	** 10.21	25.81
.95	13.60	1.86	** 9.96	25.34
1.00	13.31	1.71	** 9.76	24.92
1.20	12.54	1.44	** 9.34	23.65
1.40	12.20	1.49	** 9.35	22.90
1.60	12.11	1.74	** 9.62	22.49
1.80	12.21	2.10	** 10.06	22.33
2.00	12.44	2.51	** 10.62	22.37
2.20	12.75	2.96	** 11.26	22.54
2.40	13.13	3.43	** 11.95	22.83
2.60	13.55	3.91	** 12.68	23.20
2.80	14.01	4.40	13.43	23.63
3.00	14.50	4.89	14.20	24.10
3.20	15.00	5.40	14.98	24.60
3.40	15.52	5.91	15.77	25.12
3.60	16.04	6.43	16.55	25.65
3.80	16.57	6.96	17.34	26.18
4.00	17.11	7.51	18.12	26.71
4.20	17.65	8.06	18.90	27.24
4.40	18.19	8.62	19.67	27.75
4.60	18.72	9.18	20.44	28.26
4.80	19.26	9.75	21.20	28.77
5.00	19.79	10.32	21.95	29.27
5.20	20.32	10.88	22.69	29.77

MINICEL 12.0 IN. D.H. 1.0 IN. THICK 160.0 TEMPERATURE

STATIC STRESS		DECELERATION		(G)	
PSI	IDCC	LOWER-P		MODEL	UPPER-P
.05	90.76	76.74	**	98.47	104.78
.10	62.94	49.13	**	59.75	76.75
.15	51.69	38.08	**	43.71	65.30
.20	45.95	32.54	**	35.28	59.36
.25	42.78	29.56	**	30.43	56.00
.30	41.03	27.99	**	27.56	* 54.06
.35	40.13	27.28	**	25.91	* 52.98
.40	39.78	27.10	**	25.05	* 52.46
.45	39.81	27.30	**	24.72	* 52.32
.50	40.10	27.76	**	24.78	* 52.44
.55	40.58	28.40	**	25.12	* 52.76
.60	41.19	29.16	**	25.66	* 53.22
.65	41.91	30.03	**	26.36	* 53.79
.70	42.70	30.96	**	27.18	* 54.44
.75	43.55	31.95	**	28.08	* 55.15
.80	44.44	32.97	**	29.05	* 55.91
.85	45.36	34.02	**	30.08	* 56.71
.90	46.31	35.09	**	31.15	* 57.53
.95	47.27	36.17	**	32.25	* 58.38
1.00	48.25	37.25	**	33.38	* 59.24
1.20	52.19	41.59	**	38.00	* 62.79
1.40	56.10	45.82	**	42.68	* 66.38
1.60	59.93	49.90		47.31	* 69.96
1.80	63.64	53.79		51.82	* 73.48
2.00	67.22	57.51		56.21	* 76.93
2.20	70.67	61.06		60.46	* 80.29
2.40	74.01	64.45		64.58	83.57
2.60	77.23	67.69		68.57	86.76
2.80	80.33	70.81		72.43	89.85
3.00	83.34	73.82		76.17	92.86
3.20	86.24	76.72		79.80	95.77
3.40	89.06	79.53		83.32	98.59
3.60	91.79	82.26		86.73	101.33
3.80	94.44	84.91		90.06	103.98
4.00	97.02	87.50		93.29	106.54
4.20	99.52	90.02		96.43	109.03
4.40	101.96	92.48		99.50	111.45
4.60	104.34	94.89		102.49	113.79
4.80	106.66	97.24		105.41	116.08
5.00	108.92	99.53		108.25	118.31
5.20	111.12	101.76		111.04	120.49

MINICEL      12.0 IN. D.H.      2.0 IN. THICK      160.0 TEMPERATURE

STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G)	MODEL	UPPER-P
.05	69.17	58.88	**	65.42	79.46
.10	47.86	37.73	**	47.84	58.00
.15	38.21	28.22	**	39.69	48.20
.20	32.62	22.77	**	34.87	42.47
.25	29.00	19.29	**	31.68	38.71
.30	26.51	16.94	**	29.42	36.09
.35	24.74	15.29	**	27.76	34.18
.40	23.44	14.12	**	26.51	32.76
.45	22.48	13.29	**	25.55	31.68
.50	21.78	12.70	**	24.80	30.85
.55	21.26	12.29	**	24.22	30.22
.60	20.88	12.03	**	23.76	29.73
.65	20.62	11.88	**	23.41	29.37
.70	20.45	11.81	**	23.13	29.10
.75	20.36	11.82	**	22.92	28.90
.80	20.33	11.88	**	22.77	28.77
.85	20.34	11.99	**	22.66	28.70
.90	20.40	12.13	**	22.59	28.67
.95	20.49	12.31	**	22.55	28.68
1.00	20.61	12.51	**	22.54	28.72
1.20	21.31	13.50	**	22.72	29.13
1.40	22.23	14.65	**	23.11	29.82
1.60	23.27	15.87	**	23.64	30.68
1.80	24.38	17.11	**	24.24	31.65
2.00	25.51	18.35		24.90	32.68
2.20	26.66	19.56		25.58	33.76
2.40	27.81	20.75		26.28	34.87
2.60	28.95	21.92		26.99	35.99
2.80	30.08	23.05		27.70	37.11
3.00	31.19	24.17		28.41	38.22
3.20	32.29	25.26		29.11	39.32
3.40	33.36	26.33		29.81	40.40
3.60	34.42	27.38		30.50	41.46
3.80	35.46	28.42		31.19	42.50
4.00	36.48	29.45		31.86	43.51
4.20	37.48	30.46		32.52	44.50
4.40	38.46	31.46		33.18	45.46
4.60	39.42	32.44		33.82	46.41
4.80	40.37	33.41		34.46	47.33
5.00	41.30	34.37		35.08	48.23
5.20	42.21	35.30		35.70	49.12

MINICEL      12.0 IN. D.H.      3.0 IN. THICK      160.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)		
PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	56.09	41.47	51.39	70.71
.10	40.80	26.40	39.71	55.20
.15	33.51	19.32	33.93	47.71
.20	29.09	15.10	30.30	43.08
.25	26.08	12.29	27.76	39.87
.30	23.90	10.30	25.85	37.50
.35	22.25	8.84	24.37	35.66
.40	20.97	7.74	** 23.17	34.20
.45	19.94	6.89	** 22.19	33.00
.50	19.11	6.23	** 21.36	32.00
.55	18.44	5.72	** 20.66	31.15
.60	17.88	5.32	** 20.06	30.44
.65	17.41	5.00	** 19.54	29.82
.70	17.02	4.76	** 19.08	29.28
.75	16.70	4.58	** 18.68	28.82
.80	16.43	4.45	** 18.32	28.41
.85	16.20	4.35	** 18.01	28.05
.90	16.01	4.29	** 17.73	27.74
.95	15.86	4.25	** 17.48	27.46
1.00	15.73	4.24	** 17.25	27.22
1.20	15.43	4.35	** 16.55	26.51
1.40	15.38	4.63	** 16.07	26.13
1.60	15.47	4.98	** 15.76	25.96
1.80	15.67	5.37	** 15.55	25.96
2.00	15.93	5.78	** 15.41	26.08
2.20	16.24	6.18	** 15.34	26.30
2.40	16.58	6.58	** 15.31	26.58
2.60	16.94	6.97	15.31	26.91
2.80	17.32	7.37	15.35	27.27
3.00	17.71	7.75	15.40	27.66
3.20	18.11	8.15	15.47	28.07
3.40	18.51	8.54	15.55	28.47
3.60	18.91	8.94	15.64	28.88
3.80	19.31	9.34	15.75	29.28
4.00	19.72	9.76	15.86	29.68
4.20	20.12	10.17	15.98	30.06
4.40	20.52	10.60	16.10	30.43
4.60	20.91	11.03	16.22	30.80
4.80	21.31	11.46	16.35	31.16
5.00	21.70	11.88	16.49	31.51
5.20	22.08	12.30	16.62	31.87



MINICEL 18.0 IN. D.H. 1.0 IN. THICK -65.0 TEMPERATURE

STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	236.23	197.46	** 245.77	275.00
.10	155.96	117.83	** 158.18	194.08
.15	119.54	82.05	** 118.84	157.03
.20	98.42	61.54	** 96.25	135.29
.25	84.73	48.46	** 81.78	121.01
.30	75.30	39.61	** 71.93	111.00
.35	68.56	33.42	** 64.98	103.69
.40	63.62	29.03	** 59.99	98.21
.45	59.97	25.91	** 56.38	94.03
.50	57.26	23.71	** 53.78	90.81
.55	55.26	22.20	** 51.94	88.32
.60	53.81	21.22	** 50.68	86.40
.65	52.79	20.66	** 49.88	84.92
.70	52.12	20.43	** 49.44	83.81
.75	51.73	20.46	** 49.30	82.99
.80	51.57	20.71	** 49.40	82.43
.85	51.59	21.12	** 49.69	82.07
.90	51.78	21.68	** 50.15	81.88
.95	52.09	22.35	** 50.74	81.84
1.00	52.52	23.11	** 51.45	81.93
1.20	55.06	26.83	** 55.10	83.28
1.40	58.42	31.15	** 59.57	85.70
1.60	62.25	35.69	** 64.47	88.81
1.80	66.33	40.30	** 69.59	92.36
2.00	70.53	44.86	74.79	96.20
2.20	74.78	49.34	80.00	100.22
2.40	79.04	53.72	85.19	104.36
2.60	83.28	58.01	90.32	108.54
2.80	87.47	62.20	95.37	112.73
3.00	91.60	66.32	100.34	116.88
3.20	95.67	70.36	105.21	120.98
3.40	99.68	74.35	110.00	125.01
3.60	103.61	78.28	114.69	128.94
3.80	107.48	82.17	119.29	132.79
4.00	111.27	86.01	123.79	136.53
4.20	115.00	89.81	128.21	140.19
4.40	118.65	93.55	132.54	143.75
4.60	122.24	97.24	136.78	147.25
4.80	125.77	100.85	140.94	150.69
5.00	129.23	104.37	145.03	154.09
5.20	132.63	107.77	149.04	157.48

MINICEL      18.0 IN. D.H.      2.0 IN. THICK      -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODEL	UPPER-P	
.05	233.11	218.43	231.93	247.78	
.10	155.89	141.48	156.04	170.31	
.15	118.89	104.73	119.64	133.05	
.20	96.28	82.37	97.39	110.20	
.25	80.84	67.17	82.18	94.51	
.30	69.58	56.14	71.08	83.01	
.35	61.00	47.79	62.63	74.21	
.40	54.28	41.29	** 56.00	67.26	
.45	48.89	36.12	** 50.68	61.66	
.50	44.50	31.94	** 46.34	57.06	
.55	40.88	28.52	** 42.76	53.24	
.60	37.87	25.70	** 39.78	50.03	
.65	35.34	23.37	** 37.27	47.31	
.70	33.21	21.42	** 35.16	44.99	
.75	31.40	19.79	** 33.37	43.01	
.80	29.87	18.43	** 31.85	41.31	
.85	28.58	17.30	** 30.56	39.85	
.90	27.48	16.36	** 29.46	38.60	
.95	26.55	15.58	** 28.53	37.52	
1.00	25.76	14.94	** 27.74	36.59	
1.20	23.76	13.45	** 25.72	34.07	
1.40	23.01	13.12	** 24.94	32.91	
1.60	23.07	13.50	** 24.95	32.64	
1.80	23.66	14.34	** 25.49	32.99	
2.00	24.63	15.48	** 26.40	33.77	
2.20	25.85	16.82	** 27.56	34.88	
2.40	27.25	18.29	** 28.91	36.21	
2.60	28.79	19.87	30.39	37.71	
2.80	30.42	21.51	31.96	39.33	
3.00	32.12	23.21	33.61	41.03	
3.20	33.87	24.95	35.30	42.79	
3.40	35.65	26.73	37.02	44.58	
3.60	37.46	28.53	38.77	46.38	
3.80	39.27	30.35	40.53	48.19	
4.00	41.09	32.19	42.30	49.99	
4.20	42.92	34.04	44.07	51.79	
4.40	44.73	35.90	45.84	53.57	
4.60	46.55	37.75	47.60	55.34	
4.80	48.35	39.60	49.35	57.10	
5.00	50.14	41.42	51.09	58.86	
5.20	51.92	43.22	52.82	60.61	

MINICEL

18.0 IN. D.H.

3.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	175.41	142.18	204.33	208.64
.10	123.21	90.56	138.56	155.86
.15	97.48	65.39	106.50	129.56
.20	81.37	49.83	86.63	112.90
.25	70.10	39.10	72.86	101.10
.30	61.69	31.21	62.67	92.16
.35	55.14	25.17	54.80	85.10
.40	49.87	20.40	48.54	79.35
.45	45.55	16.56	43.45	74.55
.50	41.94	13.41	39.23	70.47
.55	38.88	10.80	35.68	66.95
.60	36.25	8.61	32.68	63.89
.65	33.98	6.77	30.11	61.20
.70	32.00	5.20	27.89	58.81
.75	30.27	3.86	25.97	56.68
.80	28.74	2.71	24.29	54.76
.85	27.38	1.72	22.83	53.04
.90	26.17	.86	21.55	51.48
.95	25.10	.13	20.42	50.07
1.00	24.13	- -	19.43	48.78
1.20	21.17	- -	16.52	44.65
1.40	19.22	- -	** 14.81	41.75
1.60	17.95	- -	** 13.88	39.72
1.80	17.15	- -	** 13.49	38.34
2.00	16.68	- -	** 13.47	37.45
2.20	16.47	- -	** 13.74	36.94
2.40	16.44	- -	** 14.21	36.73
2.60	16.56	- -	** 14.83	36.73
2.80	16.80	- -	** 15.57	36.91
3.00	17.12	- -	** 16.41	37.22
3.20	17.52	- -	** 17.31	37.61
3.40	17.98	- -	** 18.27	38.06
3.60	18.48	- -	19.27	38.56
3.80	19.02	- -	20.30	39.07
4.00	19.58	- -	21.36	39.60
4.20	20.18	.22	22.43	40.14
4.40	20.79	.91	23.52	40.67
4.60	21.42	1.63	24.62	41.22
4.80	22.07	2.36	25.73	41.78
5.00	22.72	3.09	26.84	42.36
5.20	23.38	3.79	27.95	42.98

MINICEL

18.0 IN. D.H.

1.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	165.87	142.12	** 145.75	189.61
.10	102.30	78.95	** 95.73	125.66
.15	76.53	53.56	** 76.20	99.49
.20	63.34	40.74	** 66.69	85.94
.25	56.03	33.80	** 61.81	78.26
.30	51.95	30.07	** 59.43	73.83
.35	49.83	28.29	** 58.55	71.37
.40	48.97	27.76	** 58.63	70.19
.45	48.98	28.09	** 59.34	69.87
.50	49.58	29.00	** 60.49	70.17
.55	50.62	30.34	** 61.95	70.91
.60	51.97	31.98	** 63.63	71.97
.65	53.56	33.84	** 65.47	73.28
.70	55.32	35.87	** 67.42	74.78
.75	57.22	38.02	** 69.45	76.41
.80	59.21	40.26	** 71.53	78.16
.85	61.27	42.56	** 73.66	79.99
.90	63.39	44.90	** 75.81	81.88
.95	65.55	47.27	** 77.98	83.83
1.00	67.74	49.67	** 80.15	85.81
1.20	76.60	59.25	** 88.81	93.94
1.40	85.42	68.64	** 97.26	102.19
1.60	94.04	77.71	105.41	110.37
1.80	102.40	86.39	113.26	118.41
2.00	110.49	94.70	120.78	126.28
2.20	118.29	102.64	128.01	133.94
2.40	125.82	110.25	134.96	141.39
2.60	133.09	117.55	141.64	148.62
2.80	140.11	124.57	148.07	155.64
3.00	146.90	131.35	154.28	162.44
3.20	153.47	137.91	160.27	169.03
3.40	159.84	144.26	166.06	175.41
3.60	166.01	150.44	171.67	181.59
3.80	172.01	156.45	177.11	187.57
4.00	177.84	162.30	182.39	193.37
4.20	183.50	168.01	187.52	199.00
4.40	189.02	173.58	192.50	204.46
4.60	194.40	179.02	197.35	209.78
4.80	199.64	184.31	202.08	214.96
5.00	204.75	189.47	206.69	220.04
5.20	209.75	194.47	211.18	225.02



MINICEL 18.0 IN. D.H. 2.0 IN. THICK 70.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)		
PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	120.42	94.66	** 121.97	146.18
.10	77.37	52.06	** 78.46	102.67
.15	58.25	33.39	** 59.17	83.11
.20	47.39	22.97	** 48.24	71.82
.25	40.53	16.52	** 41.34	64.53
.30	35.92	12.33	** 36.73	59.51
.35	32.73	9.54	** 33.54	55.92
.40	30.49	7.69	** 31.31	53.30
.45	28.92	6.49	** 29.76	51.35
.50	27.83	5.77	** 28.69	49.89
.55	27.11	5.40	** 27.99	48.81
.60	26.66	5.30	** 27.57	48.02
.65	26.44	5.41	** 27.37	47.47
.70	26.38	5.68	** 27.34	47.09
.75	26.47	6.07	** 27.45	46.86
.80	26.66	6.57	** 27.67	46.76
.85	26.95	7.14	** 27.98	46.76
.90	27.31	7.78	** 28.37	46.84
.95	27.73	8.47	** 28.82	47.00
1.00	28.21	9.20	** 29.33	47.22
1.20	30.48	12.38	** 31.70	48.58
1.40	33.11	15.75	** 34.42	50.47
1.60	35.90	19.13	** 37.32	52.68
1.80	38.77	22.44	40.27	55.11
2.00	41.66	25.65	43.25	57.67
2.20	44.53	28.74	46.20	60.32
2.40	47.37	31.72	49.12	63.03
2.60	50.16	34.58	51.98	65.74
2.80	52.90	37.35	54.80	68.45
3.00	55.59	40.04	57.55	71.14
3.20	58.22	42.66	60.25	73.77
3.40	60.79	45.23	62.89	76.36
3.60	63.31	47.74	65.47	78.88
3.80	65.77	50.21	67.99	81.33
4.00	68.18	52.65	70.46	83.72
4.20	70.54	55.05	72.87	86.04
4.40	72.85	57.41	75.24	88.30
4.60	75.12	59.73	77.55	90.50
4.80	77.33	62.00	79.82	92.66
5.00	79.50	64.22	82.04	94.79
5.20	81.63	66.36	84.22	96.90

MINICEL

18.0 IN. D.H.

3.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODFL	UPPER-P
.05	97.21	79.44	** 103.86	114.98
.10	63.50	46.04	** 66.12	80.96
.15	47.93	30.78	** 48.88	65.09
.20	38.75	21.89	** 38.81	55.60
.25	32.68	16.12	** 32.24	49.24
.30	28.41	12.14	** 27.67	44.69
.35	25.29	9.29	** 24.38	41.29
.40	22.94	7.21	** 21.94	38.67
.45	21.14	5.67	** 20.10	36.61
.50	19.76	4.54	** 18.72	34.97
.55	18.68	3.71	** 17.68	33.65
.60	17.84	3.11	** 16.90	32.57
.65	17.20	2.70	** 16.32	31.70
.70	16.71	2.43	** 15.92	30.99
.75	16.34	2.28	** 15.65	30.41
.80	16.08	2.23	** 15.49	29.94
.85	15.91	2.25	** 15.42	29.57
.90	15.81	2.34	** 15.43	29.28
.95	15.77	2.49	** 15.50	29.05
1.00	15.78	2.68	** 15.63	28.89
1.20	16.22	3.75	** 16.55	28.70
1.40	17.08	5.12	** 17.89	29.04
1.60	18.18	6.62	** 19.47	29.74
1.80	19.43	8.17	** 21.18	30.68
2.00	20.76	9.73	22.97	31.79
2.20	22.14	11.26	24.79	33.03
2.40	23.56	12.77	26.63	34.35
2.60	24.98	14.24	28.46	35.72
2.80	26.40	15.68	30.29	37.13
3.00	27.82	17.10	32.09	38.54
3.20	29.23	18.50	33.87	39.96
3.40	30.62	19.88	35.63	41.36
3.60	31.99	21.25	37.36	42.74
3.80	33.35	22.61	39.06	44.09
4.00	34.69	23.96	40.73	45.41
4.20	36.01	25.31	42.38	46.70
4.40	37.30	26.64	43.99	47.96
4.60	38.58	27.96	45.58	49.20
4.80	39.84	29.26	47.14	50.41
5.00	41.08	30.54	48.67	51.61
5.20	42.29	31.78	50.18	52.81

MINICEL 18.0 IN. D.H. 1.0 IN. THICK 160.0 TEMPERATURE

STATIC STRESS

PSI	IDCC	DECELERATION (G)	MODEL	UPPER-P
		LOWER-P		
.05	107.39	77.16	** 108.77	137.62
.10	73.38	43.65	** 73.21	103.11
.15	61.66	32.41	** 61.40	90.90
.20	57.00	28.23	** 57.04	85.77
.25	55.47	27.16	** 55.97	83.78
.30	55.58	27.72	** 56.58	83.45
.35	56.62	29.19	** 58.14	84.06
.40	58.23	31.22	** 60.27	85.25
.45	60.19	33.59	** 62.74	86.80
.50	62.38	36.17	** 65.43	88.60
.55	64.71	38.87	** 68.25	90.54
.60	67.12	41.65	** 71.15	92.59
.65	69.59	44.48	** 74.08	94.71
.70	72.09	47.31	** 77.02	96.87
.75	74.50	50.14	** 79.96	99.04
.80	77.09	52.95	** 82.89	101.23
.85	79.58	55.74	** 85.79	103.42
.90	82.05	58.49	** 88.66	105.60
.95	84.49	61.21	** 91.49	107.77
1.00	86.91	63.89	** 94.29	109.93
1.20	96.29	74.19	** 105.11	118.39
1.40	105.17	83.80	115.29	126.54
1.60	113.57	92.76	124.90	134.38
1.80	121.52	101.12	133.96	141.91
2.00	129.06	108.95	142.55	149.17
2.20	136.23	116.30	150.70	156.17
2.40	143.07	123.24	158.46	162.91
2.60	149.61	129.82	165.87	169.40
2.80	155.87	136.09	172.96	175.66
3.00	161.89	142.08	179.76	181.69
3.20	167.67	147.84	186.30	187.49
3.40	173.24	153.39	192.59	193.08
3.60	178.61	158.76	198.66 *	198.46
3.80	183.80	163.97	204.52 *	203.64
4.00	188.83	169.03	210.19 *	208.63
4.20	193.70	173.95	215.68 *	213.45
4.40	198.43	178.75	221.01 *	218.11
4.60	203.02	183.41	226.18 *	222.62
4.80	207.48	187.95	231.21 *	227.01
5.00	211.82	192.34	236.09 *	231.30
5.20	216.05	196.60	240.85 *	235.51

MINICEL

18.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODFL	UPPER-P
.05	78.31	63.56	** 77.96	93.06
.10	54.06	39.57	** 54.41	68.55
.15	43.97	29.73	** 44.71	58.20
.20	38.63	24.64	** 39.65	52.62
.25	35.54	21.79	** 36.77	49.29
.30	33.69	20.18	** 35.09	47.21
.35	32.61	19.32	** 34.14	45.89
.40	32.02	18.96	** 33.68	45.08
.45	31.77	18.93	** 33.53	44.62
.50	31.77	19.13	** 33.62	44.40
.55	31.94	19.50	** 33.88	44.37
.60	32.24	20.00	** 34.25	44.47
.65	32.64	20.59	** 34.72	44.68
.70	33.11	21.25	** 35.26	44.97
.75	33.64	21.96	** 35.85	45.33
.80	34.22	22.71	** 36.49	45.73
.85	34.83	23.49	** 37.15	46.18
.90	35.47	24.29	** 37.84	46.66
.95	36.13	25.10	** 38.54	47.17
1.00	36.81	25.92	** 39.26	47.70
1.20	39.60	29.23	** 42.20	49.96
1.40	42.43	32.49	** 45.16	52.37
1.60	45.24	35.64	48.08	54.85
1.80	47.99	38.64	50.92	57.34
2.00	50.66	41.50	53.68	59.83
2.20	53.26	44.22	56.35	62.30
2.40	55.77	46.81	58.94	64.74
2.60	58.21	49.29	61.43	67.13
2.80	60.57	51.66	63.85	69.48
3.00	62.86	53.95	66.19	71.76
3.20	65.08	56.16	68.46	73.99
3.40	67.23	58.31	70.66	76.15
3.60	69.32	60.40	72.80	78.25
3.80	71.36	62.44	74.87	80.28
4.00	73.34	64.43	76.89	82.25
4.20	75.27	66.38	78.86	84.15
4.40	77.15	68.29	80.77	86.00
4.60	78.98	70.16	82.63	87.80
4.80	80.77	71.98	84.45	89.55
5.00	82.51	73.76	86.23	91.27
5.20	84.22	75.48	87.97	92.96



MINICEL      18.0 IN. D.H.      3.0 IN. THICK      160.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODEL		UPPER-P
.05	62.38	54.86	**	63.06	69.89
.10	44.48	37.09	**	44.27	51.87
.15	36.43	29.16	**	35.99	43.70
.20	31.81	24.66	**	31.32	38.96
.25	28.84	21.80	**	28.39	35.89
.30	26.83	19.89	**	26.44	33.76
.35	25.40	18.58	**	25.11	32.22
.40	24.38	17.65	**	24.19	31.10
.45	23.63	17.01	**	23.56	30.25
.50	23.10	16.57	**	23.14	29.62
.55	22.72	16.28	**	22.87	29.15
.60	22.45	16.11	**	22.73	28.79
.65	22.29	16.03	**	22.67	28.54
.70	22.19	16.02	**	22.69	28.36
.75	22.16	16.07	**	22.77	28.25
.80	22.18	16.16	**	22.90	28.19
.85	22.23	16.29	**	23.06	28.17
.90	22.32	16.45	**	23.26	28.19
.95	22.44	16.64	**	23.48	28.24
1.00	22.58	16.84	**	23.72	28.32
1.20	23.32	17.80	**	24.84	28.83
1.40	24.22	18.88	**	26.11	29.55
1.60	25.21	20.01	**	27.44	30.41
1.80	26.25	21.15		28.79	31.34
2.00	27.30	22.27		30.14	32.33
2.20	28.36	23.37		31.48	33.35
2.40	29.41	24.45		32.79	34.37
2.60	30.45	25.50		34.09	35.41
2.80	31.48	26.53		35.35	36.43
3.00	32.49	27.53		36.59	37.44
3.20	33.48	28.52		37.81	38.44
3.40	34.45	29.49		38.99	39.42
3.60	35.40	30.44		40.15	40.37
3.80	36.34	31.38		41.28	41.30
4.00	37.25	32.30		42.39	42.20
4.20	38.15	33.21		43.47	43.09
4.40	39.03	34.11		44.53	43.95
4.60	39.89	35.00		45.56	44.79
4.80	40.74	35.86		46.58	45.62
5.00	41.57	36.71		47.57	46.43
5.20	42.39	37.53		48.54	47.24

MINICEL

24.0 IN. D.H.

1.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECFLERATION LOWER-P	(G) MODEL	UPPER-P
.05	299.03	235.62	** 290.24	362.44
.10	187.92	125.81	** 183.09	250.03
.15	139.04	78.19	** 136.11	199.88
.20	111.57	51.95	** 109.80	171.18
.25	94.38	35.97	** 93.41	152.79
.30	83.01	25.76	** 82.62	140.26
.35	75.27	19.16	** 75.33	131.39
.40	69.96	14.95	** 70.36	124.97
.45	66.34	12.40	** 67.03	120.29
.50	63.96	11.04	** 64.87	116.88
.55	62.49	10.57	** 63.59	114.41
.60	61.73	10.77	** 62.99	112.69
.65	61.51	11.48	** 62.90	111.54
.70	61.72	12.59	** 63.23	110.85
.75	62.27	14.00	** 63.87	110.55
.80	63.10	15.65	** 64.78	110.55
.85	64.15	17.50	** 65.91	110.81
.90	65.39	19.49	** 67.20	111.29
.95	66.78	21.60	** 68.64	111.95
1.00	68.29	23.80	** 70.19	112.78
1.20	75.20	33.13	** 77.21	117.27
1.40	82.92	42.75	** 84.98	123.08
1.60	90.99	52.27	** 93.06	129.72
1.80	99.18	61.48	101.23	136.88
2.00	107.36	70.34	109.37	144.39
2.20	115.45	78.83	117.40	152.08
2.40	123.41	86.99	125.30	159.84
2.60	131.22	94.86	133.03	167.58
2.80	138.86	102.48	140.59	175.24
3.00	146.33	109.91	147.98	182.75
3.20	153.63	117.16	155.20	190.10
3.40	160.76	124.28	162.24	197.24
3.60	167.73	131.28	169.12	204.17
3.80	174.54	138.17	175.84	210.90
4.00	181.19	144.94	182.40	217.44
4.20	187.69	151.59	188.82	223.80
4.40	194.06	158.08	195.09	230.03
4.60	200.28	164.39	201.23	236.18
4.80	206.38	170.46	207.24	242.30
5.00	212.35	176.23	213.12	248.47
5.20	218.20	181.65	218.88	254.75

MINICEL 24.0 IN. D.H. 2.0 IN. THICK -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)		
PSI	IDCC	LOWER-P	MODFL	UPPER-P
.05	262.04	203.14	273.23	320.94
.10	174.82	116.90	182.57	232.74
.15	133.46	76.49	139.47	190.43
.20	108.44	52.41	** 113.32	164.48
.25	91.51	36.38	** 95.58	146.64
.30	79.28	25.03	** 82.74	133.53
.35	70.06	16.67	** 73.03	123.45
.40	62.91	10.35	** 65.48	115.47
.45	57.25	5.49	** 59.48	109.00
.50	52.69	1.72	** 54.63	103.66
.55	48.98	- -	** 50.68	99.20
.60	45.94	- -	** 47.42	95.42
.65	43.43	- -	** 44.72	92.21
.70	41.36	- -	** 42.47	89.45
.75	39.64	- -	** 40.60	87.08
.80	38.22	- -	** 39.04	85.03
.85	37.06	- -	** 37.75	83.25
.90	36.10	- -	** 36.68	81.71
.95	35.33	- -	** 35.80	80.38
1.00	34.71	- -	** 35.09	79.23
1.20	33.45	- -	** 33.51	76.06
1.40	33.50	- -	** 33.32	74.56
1.60	34.38	- -	** 34.02	74.23
1.80	35.80	- -	** 35.29	74.73
2.00	37.58	- -	** 36.95	75.84
2.20	39.60	1.79	** 38.89	77.42
2.40	41.80	4.26	41.00	79.33
2.60	44.10	6.73	43.25	81.48
2.80	46.49	9.18	45.58	83.79
3.00	48.92	11.63	47.97	86.21
3.20	51.38	14.08	50.40	88.68
3.40	53.86	16.55	52.85	91.17
3.60	56.34	19.04	55.31	93.65
3.80	58.82	21.54	57.77	96.10
4.00	61.29	24.07	60.23	98.50
4.20	63.74	26.62	62.67	100.86
4.40	66.18	29.18	65.10	103.18
4.60	68.60	31.73	67.51	105.46
4.80	70.99	34.25	69.91	107.72
5.00	73.36	36.73	72.27	109.99
5.20	75.70	39.12	74.62	112.29

MINICEL      24.0 IN. D.H.      3.0 IN. THICK      -65.0 TEMPERATURE

STATIC STRESS

PSI	IDCC	DECELERATION (G)	MODFL	UPPER-P
		LOWER-P		
.05	253.30	219.11	240.73	287.50
.10	169.80	136.26	162.66	203.53
.15	129.54	96.45	124.77	162.62
.20	104.68	72.13	101.37	137.23
.25	87.56	55.53	85.21	119.58
.30	74.97	43.45	73.30	106.49
.35	65.30	34.28	64.14	96.33
.40	57.66	27.11	56.87	88.21
.45	51.48	21.40	50.98	81.57
.50	46.40	16.76	46.12	76.03
.55	42.16	12.96	42.06	71.36
.60	38.59	9.82	** 38.63	67.37
.65	35.57	7.20	** 35.71	63.94
.70	32.98	5.00	** 33.20	60.96
.75	30.76	3.16	** 31.04	58.36
.80	28.84	1.61	** 29.17	56.08
.85	27.19	.30	** 27.54	54.07
.90	25.75	-	** 26.13	52.30
.95	24.51	-	** 24.90	50.74
1.00	23.44	-	** 23.82	49.36
1.20	20.42	-	** 20.74	45.24
1.40	18.85	-	** 19.05	42.78
1.60	18.22	-	** 18.25	41.45
1.80	18.22	-	** 18.07	40.92
2.00	18.67	-	** 18.31	40.99
2.20	19.44	-	** 18.87	41.49
2.40	20.44	-	** 19.65	42.32
2.60	21.62	-	** 20.61	43.40
2.80	22.92	1.18	21.69	44.66
3.00	24.32	2.59	22.87	46.05
3.20	25.80	4.07	24.13	47.52
3.40	27.32	5.59	25.44	49.05
3.60	28.89	7.17	26.80	50.62
3.80	30.49	8.79	28.18	52.19
4.00	32.11	10.44	29.59	53.77
4.20	33.74	12.13	31.02	55.35
4.40	35.38	13.84	32.46	56.91
4.60	37.02	15.56	33.90	58.48
4.80	38.66	17.28	35.35	60.05
5.00	40.30	18.98	36.80	61.63
5.20	41.94	20.63	38.24	63.24



MINICEL

24.0 IN. D.H.

1.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION (G)	MODEL	UPPER-P
		LOWER-P		
.05	164.53	128.90	** 161.87	200.17
.10	105.97	71.08	** 104.57	140.86
.15	84.12	49.95	** 84.02	118.29
.20	74.18	40.71	** 75.24	107.64
.25	69.64	36.86	** 71.76	102.42
.30	67.99	35.88	** 71.06	100.10
.35	68.04	36.58	** 71.99	99.51
.40	69.16	38.32	** 73.90	99.99
.45	70.97	40.74	** 76.46	101.19
.50	73.24	43.60	** 79.43	102.88
.55	75.83	46.76	** 82.67	104.90
.60	78.63	50.12	** 86.09	107.15
.65	81.59	53.60	** 89.63	109.57
.70	84.64	57.16	** 93.24	112.12
.75	87.76	60.77	** 96.89	114.74
.80	90.91	64.40	** 100.55	117.43
.85	94.09	68.02	** 104.21	120.15
.90	97.27	71.64	** 107.86	122.90
.95	100.45	75.22	** 111.48	125.67
1.00	103.61	78.78	** 115.08	128.44
1.20	116.05	92.59	** 129.11	139.51
1.40	128.01	105.62	142.47	150.39
1.60	139.44	117.85	155.17	161.02
1.80	150.34	129.32	167.24	171.37
2.00	160.75	140.09	178.71	181.42
2.20	170.71	150.24	189.65	191.17
2.40	180.23	159.85	200.10	200.61
2.60	189.37	168.99	210.10	209.74
2.80	198.15	177.73	219.69	218.56
3.00	206.59	186.13	228.91	227.06
3.20	214.73	194.22	237.78	235.24
3.40	222.59	202.06	246.34	243.13
3.60	230.19	209.66	254.60	250.72
3.80	237.54	217.05	262.59	258.04
4.00	244.67	224.24	270.33	265.10
4.20	251.59	231.24	277.84	271.93
4.40	258.30	238.05	285.12	278.56
4.60	264.83	244.64	292.20	285.03
4.80	271.19	251.01	299.08	291.37
5.00	277.38	257.13	305.78	297.64
5.20	283.42	262.96	312.31	303.88

MINICEL

24.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION (G)

LOWER-P

MODEL

UPPER-P

.05	140.49	116.19	**	141.44	164.79
.10	87.22	63.32	**	88.97	111.13
.15	64.40	40.88	**	66.38	87.91
.20	51.93	28.80	**	53.97	75.07
.25	44.40	21.63	**	46.42	67.16
.30	39.62	17.21	**	41.59	62.03
.35	36.55	14.50	**	38.45	58.61
.40	34.62	12.90	**	36.43	56.33
.45	33.46	12.07	**	35.19	54.85
.50	32.87	11.80	**	34.50	53.94
.55	32.69	11.93	**	34.23	53.45
.60	32.82	12.36	**	34.27	53.28
.65	33.19	13.02	**	34.55	53.37
.70	33.75	13.86	**	35.01	53.65
.75	34.46	14.83	**	35.62	54.08
.80	35.28	15.91	**	36.35	54.64
.85	36.19	17.07	**	37.18	55.31
.90	37.18	18.30	**	38.08	56.06
.95	38.22	19.57	**	39.04	56.87
1.00	39.31	20.88	**	40.04	57.75
1.20	44.00	26.35	**	44.40	61.65
1.40	48.93	31.91	**	49.03	65.94
1.60	53.91	37.40		53.74	70.42
1.80	58.87	42.74		58.43	75.00
2.00	63.74	47.89		63.05	79.59
2.20	68.50	52.84		67.58	84.16
2.40	73.15	57.61		72.00	88.69
2.60	77.67	62.21		76.31	93.14
2.80	82.08	66.64		80.51	97.51
3.00	86.36	70.94		84.60	101.78
3.20	90.53	75.10		88.58	105.95
3.40	94.58	79.16		92.46	110.01
3.60	98.54	83.11		96.24	113.96
3.80	102.39	86.97		99.92	117.80
4.00	106.14	90.75		103.51	121.53
4.20	109.80	94.44		107.02	125.16
4.40	113.37	98.06		110.44	128.69
4.60	116.87	101.60		113.79	132.13
4.80	120.28	105.06		117.06	135.49
5.00	123.61	108.44		120.25	138.79
5.20	126.88	111.72		123.38	142.04

MINICEL

24.0 IN. D.H.

3.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	127.47	103.24	** 121.95	151.70
.10	80.11	56.29	** 75.87	103.93
.15	58.63	35.20	** 55.22	82.05
.20	46.17	23.13	** 43.41	69.21
.25	38.11	15.44	** 35.85	60.77
.30	32.55	10.25	** 30.73	54.85
.35	28.58	6.63	** 27.14	50.52
.40	25.67	4.07	** 24.57	47.27
.45	23.52	2.26	** 22.72	44.78
.50	21.93	.99	** 21.40	42.86
.55	20.75	.13	** 20.48	41.38
.60	19.90	- -	** 19.87	40.22
.65	19.31	- -	** 19.49	39.33
.70	18.92	- -	** 19.30	38.66
.75	18.69	- -	** 19.27	38.16
.80	18.60	- -	** 19.36	37.80
.85	18.62	- -	** 19.55	37.57
.90	18.73	.02	** 19.82	37.44
.95	18.92	.44	** 20.17	37.40
1.00	19.18	.92	** 20.58	37.43
1.20	20.60	3.22	** 22.62	38.15
1.40	22.60	5.86	** 25.09	39.51
1.60	24.96	8.64	** 27.77	41.28
1.80	27.37	11.43	** 30.55	43.31
2.00	29.86	14.19	33.37	45.53
2.20	32.38	16.90	36.20	47.86
2.40	34.90	19.53	39.00	50.27
2.60	37.41	22.10	41.77	52.72
2.80	39.89	24.61	44.50	55.17
3.00	42.34	27.06	47.17	57.62
3.20	44.75	29.46	49.80	60.03
3.40	47.12	31.82	52.38	62.41
3.60	49.44	34.15	54.90	64.74
3.80	51.73	36.45	57.37	67.01
4.00	53.97	38.72	59.79	69.23
4.20	56.18	40.96	62.17	71.40
4.40	58.34	43.17	64.49	73.51
4.60	60.46	45.35	66.77	75.57
4.80	62.55	47.50	69.01	77.60
5.00	64.59	49.59	71.20	79.60
5.20	66.61	51.63	73.35	81.59

MINICEL

24.0 IN. D.H.

1.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	INCC	LOWER-P	MODEL	UPPER-P
.05	114.18	71.93	** 117.46	156.43
.10	80.77	39.33	** 84.56	122.22
.15	71.91	31.25	** 76.32	112.56
.20	70.39	30.50	** 75.39	110.28
.25	71.95	32.80	** 77.49	111.09
.30	74.99	36.56	** 81.04	113.42
.35	78.80	41.07	** 85.31	116.53
.40	83.03	45.97	** 89.96	120.08
.45	87.46	51.05	** 94.80	123.87
.50	91.99	56.21	** 99.70	127.77
.55	96.55	61.37	** 104.61	131.72
.60	101.09	66.49	** 109.49	135.68
.65	105.58	71.55	** 114.30	139.62
.70	110.02	76.52	** 119.04	143.52
.75	114.39	81.40	** 123.70	147.38
.80	118.68	86.18	** 128.27	151.18
.85	122.89	90.86	** 132.75	154.92
.90	127.03	95.44	** 137.14	158.61
.95	131.08	99.91	** 141.44	162.25
1.00	135.05	104.29	** 145.65	165.82
1.20	150.21	120.83	** 161.68	179.59
1.40	164.26	135.94	176.51	192.58
1.60	177.35	149.81	190.31	204.89
1.80	189.61	162.59	203.21	216.62
2.00	201.14	174.45	215.33	227.83
2.20	212.02	185.51	226.77	238.54
2.40	222.34	195.89	237.60	248.80
2.60	232.16	205.70	247.90	258.62
2.80	241.51	215.01	257.71	268.02
3.00	250.46	223.91	267.09	277.02
3.20	259.04	232.45	276.08	285.63
3.40	267.28	240.68	284.71	293.88
3.60	275.21	248.63	293.02	301.79
3.80	282.86	256.33	301.02	309.38
4.00	290.24	263.80	308.75	316.68
4.20	297.38	271.04	316.21	323.71
4.40	304.29	278.05	323.45	330.53
4.60	310.99	284.82	330.46	337.16
4.80	317.50	291.33	337.26	343.67
5.00	323.82	297.55	343.87	350.09
5.20	329.97	303.45	350.30	356.49



MINICEL      24.0 IN. D.H.      2.0 IN. THICK      160.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODFL	UPPER-P	
.05	46.48	63.11	** 88.53	109.85	
.10	57.33	34.32	** 59.95	80.34	
.15	46.14	23.48	** 48.94	68.80	
.20	40.83	18.51	** 43.68	63.15	
.25	38.21	16.22	** 41.06	60.20	
.30	37.05	15.37	** 39.87	58.72	
.35	36.75	15.38	** 39.52	58.11	
.40	36.99	15.93	** 39.71	58.05	
.45	37.59	16.82	** 40.26	58.37	
.50	38.45	17.95	** 41.05	58.94	
.55	39.47	19.24	** 42.02	59.69	
.60	40.61	20.64	** 43.10	60.58	
.65	41.84	22.12	** 44.26	61.55	
.70	43.12	23.64	** 45.49	62.60	
.75	44.45	25.20	** 46.75	63.70	
.80	45.80	26.78	** 48.05	64.83	
.85	47.18	28.36	** 49.36	65.99	
.90	48.56	29.95	** 50.69	67.17	
.95	49.95	31.52	** 52.02	68.37	
1.00	51.33	33.09	** 53.35	69.57	
1.20	56.83	39.23	** 58.63	74.42	
1.40	62.15	45.06	63.76	79.24	
1.60	67.27	50.57	68.69	83.97	
1.80	72.18	55.76	73.42	88.60	
2.00	76.88	60.65	77.95	93.10	
2.20	81.38	65.28	82.30	97.48	
2.40	85.70	69.66	86.47	101.73	
2.60	89.85	73.84	90.47	105.86	
2.80	93.84	77.83	94.33	109.85	
3.00	97.69	81.67	98.04	113.70	
3.20	101.40	85.36	101.63	117.43	
3.40	104.99	88.94	105.10	121.03	
3.60	108.46	92.41	108.45	124.50	
3.80	111.82	95.78	111.70	127.86	
4.00	115.08	99.06	114.85	131.09	
4.20	118.24	102.26	117.92	134.22	
4.40	121.32	105.39	120.89	137.25	
4.60	124.31	108.43	123.79	140.19	
4.80	127.23	111.40	126.61	143.06	
5.00	130.07	114.27	129.35	145.86	
5.20	132.84	117.06	132.03	148.62	

MINICEL

24.0 IN. D.H.

3.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	75.88	62.26	** 72.90	89.51
.10	49.85	36.45	** 48.12	63.25
.15	38.73	25.55	** 37.72	51.91
.20	32.67	19.70	** 32.17	45.63
.25	29.02	16.26	** 28.92	41.78
.30	26.72	14.17	** 26.94	39.27
.35	25.25	12.90	** 25.74	37.61
.40	24.34	12.17	** 25.05	36.50
.45	23.80	11.82	** 24.72	35.78
.50	23.54	11.74	** 24.64	35.33
.55	23.47	11.85	** 24.74	35.10
.60	23.56	12.11	** 24.98	35.02
.65	23.77	12.47	** 25.32	35.06
.70	24.06	12.93	** 25.74	35.20
.75	24.43	13.44	** 26.22	35.42
.80	24.85	14.01	** 26.75	35.70
.85	25.32	14.61	** 27.32	36.02
.90	25.82	15.25	** 27.92	36.39
.95	26.35	15.90	** 28.54	36.79
1.00	26.90	16.58	** 29.18	37.23
1.20	29.26	19.36	** 31.84	39.15
1.40	31.73	22.18	** 34.57	41.27
1.60	34.22	24.94	37.28	43.49
1.80	36.69	27.61	39.95	45.77
2.00	39.12	30.18	42.55	48.05
2.20	41.40	32.65	45.08	50.33
2.40	43.80	35.01	47.53	52.58
2.60	46.05	37.29	49.91	54.81
2.80	48.24	39.49	52.22	56.99
3.00	50.36	41.61	54.46	59.12
3.20	52.43	43.67	56.64	61.19
3.40	54.45	45.68	58.75	63.21
3.60	56.41	47.64	60.81	65.18
3.80	58.32	49.55	62.80	67.08
4.00	60.18	51.43	64.75	68.93
4.20	62.00	53.26	66.64	70.73
4.40	63.77	55.06	68.49	72.48
4.60	65.50	56.82	70.29	74.18
4.80	67.19	58.54	72.05	75.84
5.00	68.84	60.22	73.77	77.47
5.20	70.46	61.84	75.45	79.08

MINICEL 30.0 IN. D.H. 1.0 IN. THICK -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODEL	UPPER-P	
.05	322.39	264.16	** 329.41	380.62	
.10	200.75	143.68	** 205.03	257.82	
.15	148.49	92.55	** 151.32	204.43	
.20	119.86	65.02	** 121.73	174.70	
.25	102.49	48.72	** 103.65	156.26	
.30	91.43	38.70	** 92.04	144.16	
.35	84.28	32.56	** 84.44	135.99	
.40	79.71	28.97	** 79.50	130.45	
.45	76.94	27.15	** 76.40	126.73	
.50	75.46	26.59	** 74.64	124.32	
.55	74.92	26.94	** 73.86	122.91	
.60	75.11	27.99	** 73.83	122.24	
.65	75.85	29.56	** 74.38	122.15	
.70	77.02	31.52	** 75.37	122.52	
.75	78.53	33.79	** 76.71	123.27	
.80	80.31	36.30	** 78.34	124.31	
.85	82.30	39.00	** 80.19	125.60	
.90	84.46	41.83	** 82.22	127.08	
.95	86.76	44.77	** 84.40	128.74	
1.00	89.17	47.79	** 86.70	130.54	
1.20	99.54	60.32	** 96.70	138.76	
1.40	110.51	72.99	** 107.36	148.03	
1.60	121.65	85.41	118.25	157.88	
1.80	132.72	97.41	129.11	168.03	
2.00	143.62	108.94	139.84	178.31	
2.20	154.30	119.99	150.35	188.60	
2.40	164.72	130.61	160.63	198.82	
2.60	174.87	140.85	170.66	208.88	
2.80	184.75	150.74	180.44	218.75	
3.00	194.37	160.34	189.96	228.39	
3.20	203.73	169.69	199.23	237.77	
3.40	212.85	178.82	208.27	246.88	
3.60	221.73	187.74	217.07	255.71	
3.80	230.38	196.48	225.66	264.29	
4.00	238.82	205.03	234.04	272.62	
4.20	247.06	213.39	242.22	280.73	
4.40	255.10	221.54	250.21	288.67	
4.60	262.96	229.45	258.01	296.46	
4.80	270.63	237.08	265.64	304.19	
5.00	278.14	244.39	273.11	311.90	
5.20	285.49	251.31	280.41	319.66	

MINICEL

30.0 IN. D.H.

2.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	1000	LOWER-P	MODEL	UPPER-P
.05	330.35	309.58	** 309.62	350.91
.10	211.19	190.94	** 205.95	231.44
.15	155.62	135.68	** 156.93	175.57
.20	122.52	102.88	** 127.36	142.17
.25	100.47	81.11	** 107.39	119.83
.30	84.79	65.71	** 93.01	103.87
.35	73.18	54.37	** 82.20	91.99
.40	64.34	45.79	** 73.84	82.89
.45	57.49	39.19	** 67.23	75.78
.50	52.10	34.05	** 61.94	70.15
.55	47.83	30.02	** 57.65	65.65
.60	44.44	26.85	** 54.15	62.03
.65	41.74	24.38	** 51.28	59.11
.70	39.61	22.46	** 48.92	56.77
.75	37.94	20.98	** 46.98	54.89
.80	36.65	19.89	** 45.39	53.40
.85	35.67	19.10	** 44.09	52.24
.90	34.97	18.58	** 43.04	51.36
.95	34.50	18.27	** 42.21	50.72
1.00	34.22	18.16	** 41.56	50.28
1.20	34.58	19.09	** 40.37	50.06
1.40	36.53	21.50	** 40.71	51.55
1.60	39.43	24.77	** 42.01	54.10
1.80	42.94	28.54	** 43.93	57.34
2.00	46.82	32.61	** 46.26	61.03
2.20	50.94	36.86	48.86	65.01
2.40	55.20	41.20	51.65	69.19
2.60	59.54	45.59	54.57	73.49
2.80	63.93	50.00	57.57	77.85
3.00	68.32	54.41	60.62	82.24
3.20	72.71	58.80	63.70	86.62
3.40	77.07	63.17	66.79	90.97
3.60	81.39	67.50	69.88	95.28
3.80	85.67	71.80	72.96	99.55
4.00	89.91	76.06	76.02 *	103.75
4.20	94.09	80.28	79.06 *	107.90
4.40	98.22	84.44	82.07 *	111.99
4.60	102.29	88.55	85.06 *	116.03
4.80	106.30	92.59	88.01 *	120.02
5.00	110.26	96.56	90.94 *	123.97
5.20	114.17	100.44	93.83 *	127.90



MINICEL 30.0 IN. D.H. 3.0 IN. THICK -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODEL	UPPER-P	
.05	279.21	238.00	272.80	320.42	
.10	185.52	145.00	183.88	226.04	
.15	140.53	100.69	140.86	180.38	
.20	113.01	73.81	114.35	152.20	
.25	94.17	55.61	96.09	132.72	
.30	80.40	42.47	82.67	118.33	
.35	69.91	32.58	72.36	107.24	
.40	61.66	24.92	64.21	98.40	
.45	55.04	18.87	57.62	91.22	
.50	49.64	14.01	52.20	85.26	
.55	45.17	10.08	47.68	80.26	
.60	41.44	6.86	** 43.87	76.02	
.65	38.31	4.23	** 40.64	72.38	
.70	35.65	2.06	** 37.88	69.25	
.75	33.40	.27	** 35.51	66.54	
.80	31.49	- -	** 33.46	64.18	
.85	29.86	- -	** 31.70	62.12	
.90	28.46	- -	** 30.17	60.32	
.95	27.28	- -	** 28.84	58.74	
1.00	26.28	- -	** 27.69	57.36	
1.20	23.65	- -	** 24.46	53.39	
1.40	22.57	- -	** 22.78	51.23	
1.60	22.48	- -	** 22.10	50.28	
1.80	23.06	- -	** 22.10	50.21	
2.00	24.09	- -	** 22.57	50.77	
2.20	25.45	- -	** 23.39	51.80	
2.40	27.03	.89	** 24.45	53.17	
2.60	28.79	2.77	** 25.70	54.80	
2.80	30.66	4.71	27.08	56.62	
3.00	32.63	6.70	28.57	58.55	
3.20	34.65	8.74	30.14	60.57	
3.40	36.72	10.82	31.76	62.63	
3.60	38.82	12.94	33.43	64.71	
3.80	40.94	15.10	35.13	66.79	
4.00	43.07	17.29	36.85	68.86	
4.20	45.21	19.50	38.58	70.92	
4.40	47.34	21.71	40.33	72.97	
4.60	49.47	23.92	42.08	75.01	
4.80	51.58	26.11	43.82	77.06	
5.00	53.69	28.25	45.57	79.13	
5.20	55.78	30.33	47.31	81.24	

MINICEL

30.0 IN. D.H.

1.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	171.41	135.21	** 176.08	207.60
.10	109.23	73.78	** 112.35	144.69
.15	89.22	54.49	** 90.90	123.95
.20	82.34	48.32	** 82.78	116.36
.25	81.18	47.85	** 80.53	114.52
.30	82.96	50.29	** 81.31	115.63
.35	86.36	54.34	** 83.82	118.38
.40	90.72	59.33	** 87.36	122.11
.45	95.65	64.86	** 91.54	126.43
.50	100.92	70.73	** 96.11	131.11
.55	106.39	76.77	** 100.92	136.02
.60	111.97	82.90	** 105.88	141.05
.65	117.59	89.05	** 110.92	146.14
.70	123.22	95.16	** 115.99	151.26
.75	128.82	101.27	** 121.06	156.36
.80	134.37	107.30	** 126.11	161.45
.85	139.87	113.24	** 131.12	166.49
.90	145.30	119.10	** 136.09	171.49
.95	150.65	124.87	** 141.00	176.44
1.00	155.93	130.54	** 145.85	181.33
1.20	176.26	152.24	** 164.61	200.28
1.40	195.36	172.42	182.31	218.30
1.60	213.31	191.18	199.01	235.43
1.80	230.22	208.68	214.80	251.77
2.00	246.22	225.06	229.75	267.38
2.20	261.40	240.46	243.96	282.33
2.40	275.83	255.02	257.49	296.65
2.60	289.60	268.83	270.42	310.37
2.80	302.77	282.00	282.79	323.54
3.00	315.39	294.60	294.67	336.18
3.20	327.51	306.71	306.08 *	348.31
3.40	339.18	318.38	317.06 *	359.98
3.60	350.43	329.66	327.66 *	371.20
3.80	361.29	340.57	337.90 *	382.00
4.00	371.79	351.14	347.81 *	392.44
4.20	381.95	361.38	357.41 *	402.53
4.40	391.81	371.29	366.72 *	412.34
4.60	401.38	380.86	375.75 *	421.89
4.80	410.67	390.09	384.54 *	431.26
5.00	419.72	398.95	393.09 *	440.48
5.20	428.52	407.41	401.41 *	449.62

MINICEL

30.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	148.46	129.32	** 158.59	167.60
.10	92.37	73.55	** 98.24	111.19
.15	69.03	50.52	** 72.73	87.55
.20	56.72	38.51	** 59.02	74.93
.25	49.59	31.67	** 50.89	67.51
.30	45.34	27.71	** 45.88	62.98
.35	42.85	25.49	** 42.78	60.21
.40	41.51	24.42	** 40.94	58.60
.45	40.96	24.13	** 39.97	57.79
.50	40.97	24.39	** 39.62	57.54
.55	41.38	25.05	** 39.72	57.71
.60	42.09	26.00	** 40.17	58.19
.65	43.04	27.17	** 40.87	58.90
.70	44.15	28.51	** 41.77	59.79
.75	45.40	29.97	** 42.83	60.83
.80	46.75	31.52	** 44.00	61.98
.85	48.18	33.15	** 45.28	63.21
.90	49.67	34.83	** 46.62	64.51
.95	51.21	36.56	** 48.03	65.87
1.00	52.79	38.30	** 49.49	67.27
1.20	59.29	45.43	** 55.59	73.15
1.40	65.89	52.54	** 61.90	79.24
1.60	72.43	59.48	68.20	85.38
1.80	78.83	66.19	74.42	91.47
2.00	85.05	72.64	80.49	97.46
2.20	91.08	78.83	86.41	103.34
2.40	96.93	84.78	92.16	109.08
2.60	102.59	90.51	97.74	114.67
2.80	108.08	96.04	103.16	120.12
3.00	113.40	101.37	108.43	125.42
3.20	118.56	106.54	113.54	130.57
3.40	123.56	111.55	118.51	135.57
3.60	128.43	116.42	123.34	140.43
3.80	133.15	121.17	128.05	145.14
4.00	137.75	125.79	132.63	149.72
4.20	142.23	130.30	137.10	154.17
4.40	146.60	134.69	141.46	158.51
4.60	150.86	138.98	145.71	162.74
4.80	155.01	143.16	149.86	166.87
5.00	159.07	147.22	153.92	170.93
5.20	163.04	151.16	157.88	174.91

MINICEL 30.0 IN. D.H. 3.0 IN. THICK 70.0 TEMPERATURE

STATIC STRESS

PSI	IDCC	DECELERATION (G)	MODEL	UPPER-P
.05	131.31	111.17	** 137.89	151.44
.10	83.29	63.49	** 84.45	103.10
.15	61.87	42.39	** 60.81	81.36
.20	49.65	30.48	** 47.45	68.83
.25	41.88	23.01	** 39.04	60.75
.30	36.63	18.06	** 33.43	55.21
.35	32.97	14.68	** 29.57	51.26
.40	30.38	12.37	** 26.89	48.39
.45	28.53	10.79	** 25.03	46.27
.50	27.23	9.75	** 23.77	44.71
.55	26.34	9.11	** 22.95	43.57
.60	25.77	8.78	** 22.48	42.75
.65	25.44	8.69	** 22.28	42.19
.70	25.30	8.78	** 22.28	41.83
.75	25.32	9.02	** 22.45	41.63
.80	25.47	9.38	** 22.76	41.57
.85	25.73	9.84	** 23.19	41.62
.90	26.07	10.37	** 23.70	41.77
.95	26.48	10.97	** 24.28	42.00
1.00	26.95	11.62	** 24.93	42.29
1.20	29.27	14.56	** 27.97	43.97
1.40	32.00	17.81	** 31.43	46.19
1.60	34.94	21.15	** 35.08	48.73
1.80	37.98	24.49	38.80	51.46
2.00	41.04	27.78	42.54	54.31
2.20	44.11	31.00	46.25	57.21
2.40	47.14	34.13	49.90	60.14
2.60	50.13	37.18	53.49	63.07
2.80	53.06	40.15	57.01	65.98
3.00	55.95	43.04	60.46	68.85
3.20	58.77	45.87	63.83	71.67
3.40	61.54	48.65	67.13	74.44
3.60	64.25	51.37	70.35	77.14
3.80	66.91	54.03	73.50	79.78
4.00	69.50	56.66	76.59	82.35
4.20	72.05	59.23	79.60	84.87
4.40	74.54	61.76	82.55	87.33
4.60	76.98	64.23	85.44	89.73
4.80	79.38	66.65	88.27	92.10
5.00	81.72	69.00	91.04	94.44
5.20	84.02	71.28	93.76	96.77



MINICEL

30.0 IN. D.H.

1.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	135.86	85.01	** 125.12	186.72
.10	93.01	43.13	** 94.56	142.88
.15	83.99	35.06	** 89.46	132.91
.20	84.77	36.77	** 91.56	132.78
.25	89.49	42.39	** 96.46	136.60
.30	96.01	49.77	** 102.58	142.25
.35	103.39	57.99	** 109.25	148.79
.40	111.17	66.59	** 116.12	155.76
.45	119.10	75.30	** 123.04	162.90
.50	127.04	83.99	** 129.90	170.08
.55	134.91	92.59	** 136.65	177.22
.60	142.67	101.05	** 143.27	184.28
.65	150.28	109.35	** 149.74	191.22
.70	157.75	117.46	** 156.06	198.04
.75	165.05	125.38	** 162.23	204.73
.80	172.20	133.12	** 168.25	211.28
.85	179.18	140.66	** 174.12	217.70
.90	186.01	148.03	** 179.85	223.99
.95	192.69	155.21	** 185.44	230.16
1.00	199.21	162.22	** 190.89	236.20
1.20	223.95	188.64	211.52	259.26
1.40	246.73	212.72	230.44	280.75
1.60	267.85	234.79	247.94	300.92
1.80	287.55	255.14	264.22	319.96
2.00	306.02	274.02	279.45	338.01
2.20	323.41	291.65	293.79	355.17
2.40	339.86	308.21	307.33	* 371.51
2.60	355.48	323.85	320.16	* 387.11
2.80	370.35	338.70	332.38	* 401.99
3.00	384.54	352.87	344.03	* 416.22
3.20	398.14	366.44	355.18	* 429.83
3.40	411.18	379.50	365.87	* 442.86
3.60	423.72	392.08	376.15	* 455.35
3.80	435.80	404.24	386.04	* 467.35
4.00	447.45	415.99	395.57	* 478.90
4.20	458.71	427.36	404.78	* 490.05
4.40	469.60	438.34	413.70	* 500.87
4.60	480.16	448.92	422.33	* 511.40
4.80	490.40	459.09	430.69	* 521.72
5.00	500.35	468.80	438.82	* 531.89
5.20	510.02	478.02	446.72	* 542.01

MINICEL

30.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	97.31	73.15	** 97.84	121.47
.10	63.54	39.76	** 64.84	87.31
.15	51.38	27.99	** 52.67	74.78
.20	46.16	23.14	** 47.23	69.19
.25	44.06	21.39	** 44.84	66.73
.30	43.60	21.28	** 44.08	65.93
.35	44.10	22.12	** 44.26	66.09
.40	45.19	23.54	** 45.03	66.85
.45	46.66	25.32	** 46.19	68.00
.50	48.37	27.34	** 47.60	69.40
.55	50.25	29.51	** 49.19	70.98
.60	52.23	31.78	** 50.89	72.67
.65	54.28	34.11	** 52.67	74.45
.70	56.38	36.48	** 54.50	76.28
.75	58.49	38.85	** 56.36	78.14
.80	60.62	41.23	** 58.24	80.02
.85	62.75	43.60	** 60.13	81.91
.90	64.88	45.95	** 62.01	83.80
.95	66.99	48.28	** 63.89	85.70
1.00	69.08	50.58	** 65.77	87.58
1.20	77.25	59.50	** 73.10	95.01
1.40	85.05	67.90	80.14	102.20
1.60	92.46	75.78	86.84	109.13
1.80	99.49	83.18	93.24	115.81
2.00	106.19	90.14	99.33	122.25
2.20	112.58	96.70	105.15	128.46
2.40	118.68	102.92	110.72	134.44
2.60	124.52	108.82	116.06	140.21
2.80	130.12	114.46	121.18	145.78
3.00	135.51	119.86	126.11	151.15
3.20	140.69	125.04	130.86	156.34
3.40	145.69	130.04	135.44	161.33
3.60	150.52	134.87	139.86	166.16
3.80	155.18	139.56	144.15	170.81
4.00	159.71	144.10	148.30	175.32
4.20	164.09	148.51	152.33	179.67
4.40	168.35	152.80	156.24	183.89
4.60	172.48	156.98	160.04	187.99
4.80	176.51	161.03	163.74	191.99
5.00	180.42	164.95	167.34	195.90
5.20	184.24	168.74	170.86	199.74

MINICEL 30.0 IN. D.H. 3.0 IN. THICK 160.0 TEMPFRATURE

STATIC STRESS		DECELERATION		(G)	
PSI	IDCC	LOWER-P		MODEL	UPPER-P
.05	78.71	68.53	**	81.57	88.89
.10	53.35	43.34	**	51.51	63.37
.15	42.80	32.95	**	39.25	52.65
.20	37.23	27.54	**	32.93	46.93
.25	34.01	24.47	**	29.38	43.55
.30	32.08	22.69	**	27.37	41.47
.35	30.95	21.71	**	26.29	40.20
.40	30.34	21.24	**	25.81	39.45
.45	30.09	21.12	**	25.74	39.06
.50	30.09	21.25	**	25.95	38.93
.55	30.28	21.56	**	26.38	38.99
.60	30.60	22.01	**	26.96	39.18
.65	31.02	22.55	**	27.65	39.49
.70	31.52	23.17	**	28.42	39.87
.75	32.08	23.84	**	29.26	40.32
.80	32.69	24.55	**	30.15	40.83
.85	33.33	25.30	**	31.08	41.37
.90	34.01	26.07	**	32.03	41.94
.95	34.70	26.86	**	33.00	42.54
1.00	35.41	27.66	**	33.99	43.16
1.20	38.34	30.91	**	38.01	45.78
1.40	41.32	34.14	**	42.02	48.50
1.60	44.27	37.29		45.96	51.25
1.80	47.16	40.33		49.78	53.98
2.00	49.96	43.25		53.49	56.68
2.20	52.69	46.05		57.06	59.33
2.40	55.32	48.73		60.52	61.92
2.60	57.88	51.32		63.86	64.45
2.80	60.36	53.80		67.09	* 66.91
3.00	62.76	56.21		70.21	* 69.30
3.20	65.08	58.54		73.23	* 71.63
3.40	67.34	60.80		76.16	* 73.89
3.60	69.54	63.00		79.01	* 76.08
3.80	71.67	65.14		81.77	* 78.21
4.00	73.75	67.22		84.45	* 80.28
4.20	75.77	69.26		87.06	* 82.29
4.40	77.74	71.25		89.60	* 84.24
4.60	79.66	73.18		92.08	* 86.15
4.80	81.54	75.07		94.50	* 88.01
5.00	83.37	76.90		96.86	* 89.84
5.20	85.16	78.68		99.16	* 91.65

SECTION II  
POLYETHYLENE FOAM  
DOW ETHAFOAM (2 Lb./Ft.<sup>3</sup>)



## ETHAFOAM 2 MODEL VALIDATION

MICOM Report No. RL-CR-75-4 [3] developed individual dynamic cushioning curves, 72 out of 72 being statistically significant at an alpha level of .05. This result implied that the 2 lb./ft.<sup>3</sup> density Ethafoam material performs in a very consistent manner over a wide range of temperature, thickness, and drop height.

The model validation for Ethafoam 2 followed the same procedure developed for the Minicel material. Table 2 presents the coefficients and variables for the Ethafoam 2 model. As was expected, based upon previous work, the Ethafoam 2 material is very well behaved at the critical region of the dynamic cushioning curve.

Seventy two different combinations of drop height, temperature, and cushion thickness were evaluated. Fourteen of these combinations could not achieve the criteria established for model validation. However, it should be observed that in 8 of the 14 cases, shown in pages 50 through 57, only one data point, at the .05 psi static stress level, was outside of the prediction limit range. This static stress value, .05 psi, is at the lower end of the experimental test scale. It would be a rare instance in which such a low static stress level would be encountered in a cushioning system design. For this reason, these 8 cases are not considered to be of a significant nature with regard to validation of the Ethafoam 2 model.

One case exists, shown on page 58, which show two data points at the lower end of the experimental test scale, which are outside of the IDCC prediction limit. However, in this case, the difference between the minimum model G value and the points in question calculated by the model, is approximately 45G's, thus being far removed from the "design region." Several points are noted to be outside of the prediction limit at the upper end of the experimental test scale. However, for this

TABLE 2  
ETHAFOAM 2 MODEL

Variable	Coefficient	$\theta$	$\theta^2$	$\theta^3$	$h^{1/2}$	$T^{-1/2}$	$T^{-3/2}$	$(\ln \sigma_s)$	$(\ln \sigma_s)^2$
0	22.673363								
1	0.0	X				X			
2	0.0	X				X		X	
3	0.0	X				X			X
4	-38.759499	X			X		X		
5	0.0	X			X		X	X	
6	1.2035002	X			X		X		X
7	202.39926	X			X	X			
8	-53.355374	X			X	X		X	
9	2.9700805	X			X	X			X
10	0.0		X			X			
11	0.0		X			X		X	
12	0.0		X			X			X
13	5.9886026		X		X		X		
14	0.0		X		X		X	X	
15	0.0		X		X		X		X
16	-45.752170		X		X	X			
17	8.1253357		X		X	X		X	
18	0.0		X		X	X			X
19	0.0			X		X			
20	0.0			X		X		X	
21	-0.0096247450			X		X			X
22	0.0			X	X		X		
23	0.0			X	X		X	X	
24	-0.02080280			X	X		X		X
25	2.2706984			X	X	X			
26	0.0			X	X	X		X	
27	-0.007325251			X	X	X			X
28	-418.94060	X					X		
29	156.40775	X					X	X	
30	-15.003939	X					X		X
31	133.99960		X				X		
32	-38.926690		X				X	X	
33	2.2085893		X				X		X
34	-10.473401			X			X		
35	2.1412173			X			X	X	
36	0.0			X			X		X

case, the deviant points are beyond the established validation procedure criteria.

Three additional cases exist, shown on pages 59 through 61, which deal with the extremities of the significant portion of the design curve. These three cases have points outside of the prediction limits at both ends of the significant portion of the design curve. However, once again, the model minimum G level is well removed from the points outside the prediction limits.

Although the case on page 62 contains only one point outside the significant portion, it is of more significance than the first 12 cases discussed, since it occurs at the 2.40 psi static stress level. However, it is at the extremity of the significant portion, and does not adversely affect the design region of the curve.

The remaining case has five points which are outside of the significant portion of the design curve. However, these deviant points are some 40G's removed from the minimum model value, and do not adversely affect the design region of the curve.

The remaining 58 combinations were all acceptable based upon the established validation criteria. Forty eight of these remaining 58 combinations were within the prediction limits for the entire static stress range considered. Selected samples of these combinations are shown on pages 64 through 71, since a complete set of the tested combinations is considered too voluminous for this report.

ETHAFOAM-2

12.0 IN. D.H.

2.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	79.00	68.01	** 94.71 *	90.00
.10	51.60	40.80	** 58.68	62.40
.15	38.95	28.34	** 41.94	49.56
.20	31.49	21.07	** 32.00	41.91
.25	26.56	16.32	** 25.40	36.80
.30	23.10	13.04	** 20.72	33.15
.35	20.56	10.68	** 17.28	30.44
.40	18.65	8.95	** 14.67	28.36
.45	17.20	7.66	** 12.65	26.74
.50	16.07	6.69	** 11.08	25.45
.55	15.20	5.98	** 9.84	24.42
.60	14.53	5.46	** 8.86	23.60
.65	14.01	5.09	** 8.10	22.93
.70	13.61	4.83	** 7.50	22.39
.75	13.32	4.68	** 7.03	21.96
.80	13.11	4.61	** 6.69	21.61
.85	12.97	4.60	** 6.43	21.34
.90	12.89	4.64	** 6.26	21.14
.95	12.86	4.74	** 6.15	20.99
1.00	12.87	4.87	** 6.11	20.88
1.20	13.24	5.65	** 6.35	20.83
1.40	13.95	6.71	** 7.07	21.19
1.60	14.85	7.89	** 8.06	21.81
1.80	15.87	9.13	** 9.22	22.60
2.00	16.96	10.39	10.49	23.53
2.20	18.09	11.64	11.82	24.54
2.40	19.25	12.87	13.19	25.62
2.60	20.41	14.08	14.59	26.74
2.80	21.57	15.27	15.99	27.88
3.00	22.73	16.43	17.39	29.02
3.20	23.88	17.58	18.78	30.17
3.40	25.01	18.71	20.16	31.31
3.60	26.13	19.83	21.53	32.44
3.80	27.24	20.93	22.89	33.55
4.00	28.33	22.03	24.22	34.63
4.20	29.41	23.12	25.54	35.70
4.40	30.46	24.19	26.84	36.74
4.60	31.51	25.26	28.12	37.76
4.80	32.53	26.31	29.39	38.76
5.00	33.54	27.34	30.63	39.74
5.20	34.54	28.36	31.86	40.72



ETHAFOAM-2

18.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	215.69	191.30	** 190.67 *	240.08
.10	132.66	108.69	** 117.24	156.64
.15	95.60	72.03	** 85.18	119.16
.20	74.45	51.28	** 67.31	97.61
.25	60.99	38.21	** 56.23	83.76
.30	51.90	29.50	** 48.99	74.29
.35	45.55	23.53	** 44.14	67.58
.40	41.05	19.38	** 40.88	62.72
.45	37.84	16.52	** 38.72	59.16
.50	35.58	14.59	** 37.37	56.56
.55	34.02	13.37	** 36.61	54.68
.60	33.01	12.67	** 36.31	53.35
.65	32.43	12.40	** 36.36	52.46
.70	32.19	12.45	** 36.69	51.92
.75	32.21	12.76	** 37.23	51.66
.80	32.46	13.29	** 37.95	51.64
.85	32.89	13.98	** 38.81	51.80
.90	33.47	14.81	** 39.79	52.12
.95	34.17	15.76	** 40.86	52.58
1.00	34.98	16.80	** 42.01	53.15
1.20	38.94	21.60	** 47.13	56.28
1.40	43.63	26.97	** 52.73	60.29
1.60	48.69	32.57	** 58.52	64.81
1.80	53.91	38.20	64.35	69.63
2.00	59.19	43.77	70.15	74.62
2.20	64.46	49.23	75.85	79.69
2.40	69.69	54.58	81.45	84.79
2.60	74.83	59.79	86.93	89.88
2.80	79.89	64.87	92.28	94.92
3.00	84.86	69.83	97.50	99.89
3.20	89.73	74.69	102.60	104.78
3.40	94.50	79.44	107.57	109.57
3.60	99.17	84.09	112.42	114.25
3.80	103.75	88.67	117.16	118.82
4.00	108.22	93.16	121.79	123.29
4.20	112.61	97.58	126.31	127.64
4.40	116.91	101.92	130.73	131.89
4.60	121.12	106.19	135.05	136.04
4.80	125.24	110.38	139.27	140.11
5.00	129.29	114.48	143.41	144.09
5.20	133.26	118.49	147.47	148.02

ETHAFOAM-2

18.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	133.62	122.35	**	147.42	*	144.90
.10	84.56	73.48	**	91.00		95.64
.15	61.99	51.10	**	65.18		72.89
.20	48.73	38.03	**	50.07		59.44
.25	40.02	29.50	**	40.19		50.54
.30	33.92	23.57	**	33.30		44.26
.35	29.47	19.30	**	28.32		39.65
.40	26.15	16.15	**	24.62		36.16
.45	23.63	13.79	**	21.84		33.48
.50	21.70	12.02	**	19.72		31.39
.55	20.22	10.69	**	18.12		29.76
.60	19.09	9.70	**	16.91		28.47
.65	18.23	8.98	**	16.02		27.47
.70	17.59	8.48	**	15.37		26.69
.75	17.13	8.16	**	14.93		26.10
.80	16.82	7.97	**	14.66		25.66
.85	16.63	7.91	**	14.52		25.35
.90	16.55	7.95	**	14.50		25.15
.95	16.55	8.06	**	14.58		25.04
1.00	16.63	8.25	**	14.75		25.01
1.20	17.50	9.51	**	16.01		25.49
1.40	18.94	11.27	**	17.91		26.62
1.60	20.73	13.30	**	20.18		28.15
1.80	22.71	15.47	**	22.66		29.94
2.00	24.80	17.70		25.25		31.90
2.20	26.96	19.95		27.91		33.97
2.40	29.15	22.20		30.59		36.11
2.60	31.35	24.43		33.27		38.28
2.80	33.55	26.63		35.04		40.46
3.00	35.72	28.80		38.58		42.64
3.20	37.88	30.95		41.19		44.81
3.40	40.01	33.07		43.76		46.95
3.60	42.11	35.16		46.30		49.06
3.80	44.18	37.23		48.79		51.13
4.00	46.22	39.28		51.25		53.16
4.20	48.23	41.30		53.66		55.15
4.40	50.20	43.29		56.03		57.11
4.60	52.14	45.26		58.36		59.02
4.80	54.05	47.20		60.66		60.90
5.00	55.93	49.11		62.91	*	62.75
5.20	57.78	50.98		65.13	*	64.58

ETHAFOAM-2

18.0 IN. D.H.

2.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWFR-P

MODEL

UPPER-P

.05	87.96	74.18	** 109.01 *	101.73
.10	55.83	42.30	** 66.91	69.35
.15	41.68	28.40	** 48.13	54.97
.20	33.73	20.68	** 37.43	46.78
.25	28.76	15.94	** 30.63	41.58
.30	25.47	12.87	** 26.04	38.06
.35	23.22	10.85	** 22.85	35.60
.40	21.68	9.52	** 20.58	33.84
.45	20.63	8.68	** 18.98	32.58
.50	19.94	8.19	** 17.85	31.69
.55	19.51	7.96	** 17.08	31.06
.60	19.29	7.93	** 16.58	30.64
.65	19.22	8.05	** 16.30	30.39
.70	19.28	8.28	** 16.19	30.27
.75	19.43	8.61	** 16.22	30.25
.80	19.67	9.02	** 16.36	30.32
.85	19.97	9.48	** 16.59	30.46
.90	20.32	10.00	** 16.90	30.65
.95	20.72	10.55	** 17.27	30.90
1.00	21.16	11.13	** 17.69	31.19
1.20	23.15	13.64	** 19.75	32.65
1.40	25.37	16.30	** 22.17	34.43
1.60	27.70	18.98	** 24.77	36.41
1.80	30.06	21.62	27.45	38.49
2.00	32.42	24.19	30.16	40.64
2.20	34.75	26.67	32.86	42.83
2.40	37.04	29.06	35.54	45.03
2.60	39.30	31.37	38.18	47.22
2.80	41.50	33.60	40.77	49.40
3.00	43.66	35.77	43.31	51.54
3.20	45.76	37.87	45.80	53.65
3.40	47.82	39.92	48.24	55.71
3.60	49.83	41.93	50.63	57.73
3.80	51.79	43.89	52.97	59.69
4.00	53.71	45.82	55.26	61.61
4.20	55.50	47.71	57.50	63.47
4.40	57.43	49.57	59.70	65.28
4.60	59.22	51.40	61.85	67.05
4.80	60.98	53.19	63.96	68.78
5.00	62.71	54.94	66.03	70.47
5.20	64.30	56.65	68.05	72.13

ETHAFOAM-2

30.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	160.99	144.69	** 181.30 *	177.28
.10	94.10	78.09	** 109.80	110.11
.15	65.37	49.64	** 78.10	81.10
.20	49.63	34.18	** 60.14	65.09
.25	40.09	24.91	** 48.80	55.27
.30	34.01	19.09	** 41.21	48.94
.35	30.09	15.42	** 35.98	44.76
.40	27.58	13.16	** 32.31	42.01
.45	26.07	11.89	** 29.76	40.25
.50	25.26	11.31	** 28.00	39.21
.55	24.97	11.25	** 26.85	38.69
.60	25.08	11.57	** 26.16	38.58
.65	25.49	12.20	** 25.83	38.78
.70	26.14	13.05	** 25.78	39.23
.75	26.97	14.08	** 25.96	39.87
.80	27.95	15.25	** 26.32	40.66
.85	29.05	16.53	** 26.84	41.57
.90	30.24	17.90	** 27.47	42.59
.95	31.51	19.33	** 28.22	43.69
1.00	32.84	20.82	** 29.04	44.86
1.20	38.56	27.12	** 32.94	50.01
1.40	44.61	33.62	** 37.42	55.59
1.60	50.74	40.12	42.17	61.36
1.80	56.84	46.50	47.03	67.18
2.00	62.84	52.70	51.91 *	72.99
2.20	68.72	58.70	56.77 *	78.74
2.40	74.46	64.52	61.56 *	84.40
2.60	80.05	70.14	66.27 *	89.95
2.80	85.49	75.60	70.89 *	95.39
3.00	90.79	80.89	75.42 *	100.69
3.20	95.94	86.03	79.85 *	105.86
3.40	100.96	91.03	84.18 *	110.89
3.60	105.85	95.92	88.42 *	115.79
3.80	110.62	100.68	92.57 *	120.55
4.00	115.26	105.34	96.62 *	125.18
4.20	119.80	109.90	100.59 *	129.69
4.40	124.23	114.36	104.48 *	134.09
4.60	128.55	118.73	108.28 *	138.37
4.80	132.78	123.00	112.01 *	142.56
5.00	136.91	127.17	115.66 *	146.65
5.20	140.95	131.23	119.24 *	150.68



ETHAFOAM-2

30.0 IN. D.H.

4.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	INCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	131.79	121.96	** 149.88 *	141.63
.10	84.02	74.36	** 93.10	93.68
.15	61.73	52.25	** 66.79	71.22
.20	48.46	39.14	** 51.21	57.77
.25	39.60	30.46	** 40.90	48.75
.30	33.31	24.33	** 33.62	42.30
.35	28.65	19.82	** 28.26	37.48
.40	25.10	16.43	** 24.22	33.78
.45	22.35	13.82	** 21.12	30.87
.50	20.18	11.80	** 18.71	28.56
.55	18.46	10.23	** 16.82	26.70
.60	17.10	9.00	** 15.35	25.20
.65	16.01	8.05	** 14.20	23.98
.70	15.15	7.32	** 13.31	22.99
.75	14.48	6.77	** 12.63	22.19
.80	13.95	6.37	** 12.14	21.54
.85	13.56	6.09	** 11.79	21.03
.90	13.27	5.92	** 11.56	20.63
.95	13.08	5.84	** 11.45	20.32
1.00	12.96	5.83	** 11.42	20.10
1.20	13.09	6.34	** 11.97	19.85
1.40	13.86	7.43	** 13.25	20.30
1.60	15.02	8.84	** 14.95	21.19
1.80	16.41	10.44	** 16.91	22.38
2.00	17.96	12.15	** 19.03	23.77
2.20	19.60	13.90	21.24	25.30
2.40	21.30	15.68	23.50	26.92
2.60	23.03	17.46	25.79	28.61
2.80	24.78	19.23	28.09	30.33
3.00	26.54	21.00	30.39	32.08
3.20	28.29	22.76	32.66	33.82
3.40	30.03	24.50	34.92	35.56
3.60	31.76	26.22	37.15	37.29
3.80	33.47	27.94	39.36 *	39.00
4.00	35.16	29.64	41.54 *	40.69
4.20	36.83	31.32	43.68 *	42.34
4.40	38.48	32.99	45.80 *	43.98
4.60	40.11	34.63	47.88 *	45.58
4.80	41.71	36.26	49.93 *	47.16
5.00	43.30	37.87	51.95 *	48.73
5.20	44.86	39.44	53.94 *	50.27

ETHAFOAM-2

30.0 IN. D.H.

4.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	90.95	78.99	** 107.53 *	102.91
.10	58.12	46.37	** 66.51	69.87
.15	43.15	31.60	** 47.96	54.69
.20	34.42	23.08	** 37.23	45.76
.25	28.73	17.58	** 30.30	39.88
.30	24.79	13.83	** 25.54	35.75
.35	21.94	11.17	** 22.16	32.72
.40	19.84	9.25	** 19.69	30.44
.45	18.27	7.85	** 17.88	28.70
.50	17.09	6.84	** 16.54	27.35
.55	16.21	6.12	** 15.57	26.30
.60	15.55	5.62	** 14.88	25.48
.65	15.07	5.29	** 14.40	24.85
.70	14.73	5.11	** 14.10	24.36
.75	14.52	5.03	** 13.94	24.00
.80	14.39	5.05	** 13.90	23.74
.85	14.35	5.14	** 13.95	23.57
.90	14.38	5.29	** 14.08	23.46
.95	14.45	5.49	** 14.28	23.42
1.00	14.58	5.73	** 14.53	23.43
1.20	15.44	7.01	** 15.95	23.87
1.40	16.65	8.56	** 17.78	24.74
1.60	18.07	10.24	** 19.84	25.90
1.80	19.60	11.97	** 22.02	27.23
2.00	21.19	13.71	24.26	28.68
2.20	22.82	15.43	26.51	30.21
2.40	24.45	17.12	28.77	31.78
2.60	26.08	18.78	31.00	33.38
2.80	27.69	20.40	33.21	34.99
3.00	29.29	22.00	35.39	36.59
3.20	30.87	23.56	37.53	38.18
3.40	32.42	25.11	39.64	39.74
3.60	33.95	26.63	41.71 *	41.27
3.80	35.46	28.13	43.74 *	42.78
4.00	36.93	29.62	45.73 *	44.25
4.20	38.38	31.09	47.68 *	45.68
4.40	39.81	32.54	49.60 *	47.08
4.60	41.21	33.97	51.48 *	48.45
4.80	42.59	35.38	53.33 *	49.80
5.00	43.94	36.76	55.14 *	51.12
5.20	45.27	38.11	56.92 *	52.44

ETHAFOAM-2

30.0 IN. D.H.

4.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODFL

UPPER-P

.05	72.40	59.58	**	57.77	*	85.21
.10	47.42	34.84	**	39.39		60.00
.15	36.27	23.92	**	31.60		48.62
.20	29.91	17.78	**	27.41		42.04
.25	25.86	13.95	**	24.91		37.77
.30	23.13	11.43	**	23.37		34.82
.35	21.22	9.73	**	22.41		32.71
.40	19.87	8.58	**	21.83		31.15
.45	18.90	7.82	**	21.52		29.99
.50	18.22	7.33	**	21.40		29.12
.55	17.75	7.05	**	21.42		28.46
.60	17.45	6.93	**	21.54		27.98
.65	17.28	6.93	**	21.75		27.63
.70	17.20	7.03	**	22.01		27.38
.75	17.21	7.20	**	22.32		27.23
.80	17.29	7.44	**	22.67		27.14
.85	17.42	7.72	**	23.05		27.12
.90	17.59	8.05	**	23.45		27.14
.95	17.80	8.40	**	23.87		27.21
1.00	18.05	8.78	**	24.30		27.31
1.20	19.24	10.47	**	26.13		28.01
1.40	20.66	12.30	**	28.02		29.01
1.60	22.18	14.16	**	29.91		30.20
1.80	23.75	15.99		31.78	*	31.51
2.00	25.34	17.77		33.60	*	32.91
2.20	26.93	19.49		35.38	*	34.36
2.40	28.50	21.15		37.11	*	35.84
2.60	30.05	22.76		38.80	*	37.34
2.80	31.57	24.30		40.43	*	38.84
3.00	33.07	25.81		42.02	*	40.33
3.20	34.53	27.27		43.56	*	41.80
3.40	35.97	28.70		45.05	*	43.24
3.60	37.37	30.10		46.51	*	44.65
3.80	38.75	31.48		47.93	*	46.02
4.00	40.10	32.83		49.31	*	47.37
4.20	41.42	34.17		50.66	*	48.67
4.40	42.71	35.48		51.97	*	49.94
4.60	43.98	36.78		53.26	*	51.18
4.80	45.22	38.05		54.51	*	52.39
5.00	46.44	39.30		55.73	*	53.58
5.20	47.63	40.51		56.93	*	54.75

ETHAFOAM-2

24.0 IN. D.H.

4.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	78.34	71.07 **	98.77 *	85.61
.10	51.70	44.60 **	61.61 *	58.92
.15	39.48	32.48 **	44.63	46.49
.20	32.20	25.32 **	34.72	39.08
.25	27.37	20.62 **	28.24	34.13
.30	23.97	17.33 **	23.74	30.60
.35	21.46	14.95 **	20.49	27.97
.40	19.57	13.17 **	18.08	25.96
.45	18.11	11.83 **	16.28	24.40
.50	16.98	10.81 **	14.91	23.16
.55	16.10	10.03 **	13.88	22.17
.60	15.40	9.44 **	13.11	21.37
.65	14.86	9.00 **	12.55	20.73
.70	14.45	8.68 **	12.14	20.22
.75	14.13	8.45 **	11.87	19.80
.80	13.90	8.31 **	11.72	19.48
.85	13.73	8.23 **	11.65	19.23
.90	13.62	8.21 **	11.65	19.04
.95	13.57	8.23 **	11.72	18.90
1.00	13.55	8.30 **	11.85	18.80
1.20	13.80	8.83 **	12.75	18.77
1.40	14.30	9.66 **	14.06	19.13
1.60	15.18	10.64 **	15.61	19.73
1.80	16.00	11.69 **	17.29	20.49
2.00	17.08	12.79 **	19.05	21.37
2.20	18.11	13.89	20.84	22.32
2.40	19.16	15.00	22.65	23.32
2.60	20.23	16.09	24.45 *	24.36
2.80	21.30	17.18	26.24 *	25.42
3.00	22.37	18.25	28.02 *	26.48
3.20	23.43	19.31	29.77 *	27.54
3.40	24.48	20.36	31.49 *	28.60
3.60	25.52	21.40	33.19 *	29.64
3.80	26.55	22.42	34.87 *	30.67
4.00	27.56	23.44	36.51 *	31.68
4.20	28.56	24.45	38.12 *	32.67
4.40	29.55	25.45	39.71 *	33.65
4.60	30.52	26.44	41.27 *	34.60
4.80	31.48	27.41	42.81 *	35.54
5.00	32.42	28.37	44.31 *	36.47
5.20	33.35	29.31	45.80 *	37.39



ETHAFOAM-2

18.0 IN. D.H.

4.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECCELERATION LOWER-P	(G)	MODEL	UPPER-P
.05	62.07	53.07	**	49.64 *	71.07
.10	41.36	32.52	**	33.94	50.21
.15	31.70	23.01	**	26.86	40.39
.20	25.94	17.40	**	22.79	34.48
.25	22.10	13.71	**	20.17	30.50
.30	19.37	11.12	**	18.38	27.63
.35	17.35	9.23	**	17.11	25.47
.40	15.81	7.82	**	16.20	23.79
.45	14.61	6.75	**	15.53	22.47
.50	13.67	5.94	**	15.04	21.40
.55	12.92	5.31	**	14.70	20.53
.60	12.33	4.84	**	14.45	19.82
.65	11.86	4.48	**	14.29	19.23
.70	11.48	4.21	**	14.20	18.75
.75	11.19	4.03	**	14.16	18.35
.80	10.96	3.90	**	14.16	18.02
.85	10.79	3.82	**	14.20	17.75
.90	10.66	3.79	**	14.27	17.53
.95	10.57	3.80	**	14.36	17.35
1.00	10.52	3.83	**	14.48	17.21
1.20	10.57	4.19	**	15.08	16.95
1.40	10.90	4.77	**	15.84	17.03
1.60	11.40	5.47	**	16.68	17.32
1.80	12.00	6.22	**	17.56	17.77
2.00	12.66	6.99	**	18.46 *	18.33
2.20	13.37	7.77		19.37 *	18.97
2.40	14.10	8.55		20.27 *	19.66
2.60	14.85	9.32		21.16 *	20.38
2.80	15.61	10.08		22.04 *	21.13
3.00	16.36	10.84		22.91 *	21.89
3.20	17.12	11.59		23.76 *	22.65
3.40	17.87	12.33		24.60 *	23.41
3.60	18.62	13.07		25.41 *	24.16
3.80	19.36	13.81		26.22 *	24.90
4.00	20.09	14.55		27.01 *	25.62
4.20	20.81	15.28		27.78 *	26.33
4.40	21.52	16.01		28.54 *	27.03
4.60	22.22	16.74		29.28 *	27.71
4.80	22.92	17.45		30.01 *	28.38
5.00	23.60	18.16		30.73 *	29.05
5.20	24.28	18.84		31.43 *	29.71

ETHAFOAM-2

24.0 IN. D.H.

4.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G)	MODEL	UPPER-P
.05	69.14	57.54	**	53.97 *	80.74
.10	45.41	34.02	**	36.84	56.80
.15	34.59	23.40	**	29.38	45.78
.20	28.29	17.30	**	25.24	39.28
.25	24.18	13.38	**	22.69	34.98
.30	21.33	10.72	**	21.03	31.94
.35	19.28	8.86	**	19.93	29.70
.40	17.77	7.53	**	19.19	28.01
.45	16.64	6.57	**	18.72	26.70
.50	15.79	5.89	**	18.43	25.68
.55	15.15	5.42	**	18.27	24.88
.60	14.68	5.11	**	18.22	24.25
.65	14.34	4.93	**	18.26	23.75
.70	14.10	4.84	**	18.35	23.35
.75	13.94	4.84	**	18.50	23.05
.80	13.86	4.89	**	18.68	22.82
.85	13.83	5.00	**	18.90	22.66
.90	13.85	5.16	**	19.15	22.54
.95	13.91	5.35	**	19.41	22.47
1.00	14.00	5.57	**	19.70	22.44
1.20	14.63	6.64	**	20.95	22.62
1.40	15.52	7.91	**	22.31	23.13
1.60	16.55	9.25	**	23.71	23.86
1.80	17.67	10.61	**	25.12 *	24.73
2.00	18.83	11.95		26.51 *	25.71
2.20	20.01	13.26		27.88 *	26.75
2.40	21.19	14.54		29.22 *	27.85
2.60	22.38	15.78		30.54 *	28.97
2.80	23.55	16.99		31.82 *	30.11
3.00	24.71	18.16		33.07 *	31.26
3.20	25.86	19.31		34.28 *	32.40
3.40	26.98	20.44		35.47 *	33.53
3.60	28.09	21.55		36.63 *	34.64
3.80	29.18	22.64		37.76 *	35.73
4.00	30.26	23.72		38.87 *	36.79
4.20	31.31	24.78		39.94 *	37.83
4.40	32.34	25.84		41.00 *	38.85
4.60	33.36	26.88		42.03 *	39.84
4.80	34.36	27.90		43.04 *	40.82
5.00	35.34	28.91		44.02 *	41.77
5.20	36.31	29.89		44.99 *	42.72

ETHAFOAM-2

12.0 IN. D.H.

1.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION (G)

LOWER-P

MODEL

UPPER-P

.05	123.95	115.12	**	136.49	*	132.78
.10	78.76	70.08	**	84.95		87.44
.15	58.60	50.07	**	61.67		67.13
.20	47.11	38.73	**	48.23		55.49
.25	39.80	31.57	**	39.56		48.04
.30	34.87	26.78	**	33.62		42.97
.35	31.44	23.48	**	29.39		39.40
.40	29.00	21.17	**	26.32		36.83
.45	27.27	19.57	**	24.07		34.97
.50	26.06	18.48	**	22.42		33.63
.55	25.22	17.77	**	21.23		32.68
.60	24.69	17.35	**	20.38		32.03
.65	24.39	17.16	**	19.80		31.61
.70	24.27	17.15	**	19.45		31.38
.75	24.29	17.28	**	19.27		31.30
.80	24.44	17.53	**	19.23		31.35
.85	24.69	17.88	**	19.31		31.49
.90	25.01	18.30	**	19.50		31.73
.95	25.40	18.78	**	19.76		32.03
1.00	25.85	19.32	**	20.10		32.39
1.20	28.05	21.82	**	21.95		34.28
1.40	30.64	24.66	**	24.31	*	36.61
1.60	33.42	27.65	**	26.95	*	39.20
1.80	36.29	30.67		29.73	*	41.92
2.00	39.20	33.68		32.59	*	44.71
2.20	42.09	36.65		35.46	*	47.53
2.40	44.95	39.56		38.33	*	50.35
2.60	47.78	42.41		41.18	*	53.15
2.80	50.55	45.20		43.99	*	55.91
3.00	53.28	47.92		46.76	*	58.64
3.20	55.95	50.59		49.48	*	61.31
3.40	58.56	53.19		52.16	*	63.93
3.60	61.12	55.75		54.78	*	66.49
3.80	63.63	58.26		57.36	*	68.99
4.00	66.08	60.72		59.89	*	71.44
4.20	68.48	63.14		62.37	*	73.83
4.40	70.84	65.51		64.80	*	76.16
4.60	73.14	67.84		67.19	*	78.45
4.80	75.40	70.12		69.53	*	80.68
5.00	77.62	72.36		71.83	*	82.88
5.20	79.79	74.54		74.08	*	85.04

ETHAFOAM-2

18.0 IN. D.H.

4.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL		UPPER-P
.05	72.96	66.49	88.82	*	79.42
.10	49.14	42.79	56.05	*	55.49
.15	37.80	31.55	40.86		44.04
.20	30.91	24.77	31.86		37.04
.25	26.22	20.19	25.90		32.26
.30	22.83	16.89	21.69		28.76
.35	20.26	14.42	18.60		26.09
.40	18.25	12.51	**		23.99
.45	16.66	11.01	**		22.30
.50	15.37	9.81	**		20.92
.55	14.31	8.84	**		19.78
.60	13.44	8.05	**		18.82
.65	12.71	7.41	**		18.02
.70	12.11	6.88	**		17.33
.75	11.60	6.45	**		16.75
.80	11.18	6.10	**		16.26
.85	10.83	5.82	**		15.83
.90	10.53	5.59	**		15.47
.95	10.29	5.41	**		15.16
1.00	10.09	5.28	**		14.90
1.20	9.63	5.04	**		14.22
1.40	9.54	5.13	**		13.95
1.60	9.69	5.42	**		13.95
1.80	9.99	5.83	**		14.15
2.00	10.30	6.31	**		14.47
2.20	10.87	6.84	**		14.90
2.40	11.40	7.40	**		15.40
2.60	11.97	7.98		*	15.95
2.80	12.55	8.58		*	16.53
3.00	13.16	9.18		*	17.14
3.20	13.78	9.79		*	17.76
3.40	14.40	10.41		*	18.39
3.60	15.03	11.03		*	19.02
3.80	15.65	11.66		*	19.64
4.00	16.28	12.29		*	20.27
4.20	16.90	12.92		*	20.88
4.40	17.53	13.56		*	21.49
4.60	18.14	14.19		*	22.09
4.80	18.75	14.82		*	22.69
5.00	19.36	15.44		*	23.28
5.20	19.96	16.05		*	23.87



ETHAFOAM-2      30.0 IN. D.H.      2.0 IN. THICK      -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)			
PSI	IDCC	LOWER-P	MODEL		UPPER-P
.05	313.44	299.68	336.38	*	327.19
.10	201.20	187.68	221.34	*	214.72
.15	148.28	134.99	166.45	*	161.57
.20	116.43	103.37	** 133.05	*	129.49
.25	94.98	82.14	** 110.32	*	107.83
.30	79.57	66.94	** 93.81	*	92.20
.35	68.03	55.60	** 81.30	*	80.45
.40	59.12	46.90	** 71.52	*	71.34
.45	52.11	40.09	** 63.73		64.13
.50	46.51	34.68	** 57.41		58.35
.55	42.00	30.35	** 52.22		53.64
.60	38.33	26.86	** 47.93		49.79
.65	35.33	24.04	** 44.36		46.63
.70	32.89	21.76	** 41.37		44.01
.75	30.89	19.92	** 38.85		41.86
.80	29.27	18.46	** 36.75		40.08
.85	27.97	17.30	** 34.98		38.63
.90	26.93	16.41	** 33.50		37.45
.95	26.12	15.74	** 32.26		36.50
1.00	25.51	15.26	** 31.24		35.75
1.20	24.54	14.76	** 28.81		34.32
1.40	25.21	15.81	** 28.19		34.60
1.60	26.88	17.79	** 28.72		35.98
1.80	29.21	20.34	** 30.02		38.07
2.00	31.96	23.26	** 31.84		40.66
2.20	34.90	26.41	** 34.01		43.58
2.40	38.22	29.70	36.44		46.74
2.60	41.56	33.08	39.04		50.05
2.80	44.90	36.52	41.77		53.46
3.00	48.46	39.99	44.58		56.94
3.20	51.96	43.47	47.46		60.44
3.40	55.46	46.96	50.37		63.95
3.60	58.95	50.45	53.30		67.45
3.80	62.42	53.92	56.24		70.92
4.00	65.87	57.38	59.18		74.36
4.20	69.20	60.82	62.12		77.77
4.40	72.68	64.23	65.03		81.13
4.60	76.04	67.62	67.94		84.45
4.80	79.35	70.97	70.82	*	87.74
5.00	82.63	74.28	73.68	*	90.98
5.20	85.87	77.55	76.51	*	94.20

ETHAFOAM-2

12.0 IN. D.H.

1.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	173.75	156.18	187.51	191.32
.10	119.70	102.45	125.06	136.95
.15	93.74	76.81	95.17	110.68
.20	77.86	61.23	76.95	94.49
.25	67.00	50.67	64.51	83.33
.30	59.06	43.02	55.45	75.09
.35	53.00	37.25	48.57	68.76
.40	48.25	32.78	43.18	63.72
.45	44.43	29.23	38.86	59.63
.50	41.31	26.38	35.36	56.25
.55	38.74	24.06	32.47	53.42
.60	36.59	22.16	** 30.07	51.02
.65	34.78	20.59	** 28.06	48.97
.70	33.25	19.30	** 26.37	47.21
.75	31.96	18.23	** 24.95	45.68
.80	30.85	17.35	** 23.75	44.36
.85	29.91	16.62	** 22.73	43.20
.90	29.11	16.02	** 21.87	42.19
.95	28.43	15.54	** 21.15	41.31
1.00	27.85	15.15	** 20.54	40.55
1.20	26.34	14.34	** 19.03	38.34
1.40	25.72	14.29	** 18.52	37.14
1.60	25.67	14.72	** 18.66	36.63
1.80	26.01	15.42	** 19.22	36.59
2.00	26.60	16.30	** 20.07	36.91
2.20	27.39	17.28	** 21.13	37.50
2.40	28.31	18.33	** 22.33	38.28
2.60	29.32	19.43	** 23.63	39.21
2.80	30.40	20.56	25.01	40.25
3.00	31.54	21.72	26.44	41.36
3.20	32.71	22.89	27.91	42.53
3.40	33.91	24.09	29.40	43.73
3.60	35.12	25.30	30.91	44.94
3.80	36.35	26.53	32.42	46.16
4.00	37.58	27.77	33.94	47.38
4.20	38.81	29.03	35.46	48.59
4.40	40.04	30.29	36.97	49.79
4.60	41.27	31.56	38.47	50.98
4.80	42.49	32.83	39.97	52.16
5.00	43.71	34.08	41.46	53.33
5.20	44.92	35.32	42.93	54.52

ETHAFOAM-2

12.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	116.16	104.56	126.05	127.76
.10	75.28	63.89	79.14	86.67
.15	55.90	44.80	57.02	67.18
.20	44.37	33.38	** 43.72	55.36
.25	36.54	25.75	** 34.75	47.34
.30	30.92	20.31	** 28.31	41.52
.35	26.70	16.28	** 23.49	37.11
.40	23.44	13.20	** 19.77	33.68
.45	20.87	10.81	** 16.84	30.93
.50	18.82	8.93	** 14.50	28.71
.55	17.16	7.44	** 12.62	26.89
.60	15.82	6.25	** 11.08	25.38
.65	14.72	5.31	** 9.83	24.12
.70	13.81	4.56	** 8.81	23.07
.75	13.08	3.97	** 7.98	22.19
.80	12.48	3.51	** 7.30	21.44
.85	11.90	3.17	** 6.76	20.82
.90	11.61	2.91	** 6.33	20.30
.95	11.30	2.74	** 5.99	19.87
1.00	11.07	2.63	** 5.73	19.52
1.20	10.60	2.69	** 5.33	18.69
1.40	10.91	3.27	** 5.61	18.54
1.60	11.40	4.16	** 6.32	18.83
1.80	12.32	5.21	** 7.29	19.42
2.00	13.30	6.37	** 8.44	20.23
2.20	14.38	7.58	** 9.71	21.19
2.40	15.54	8.82	11.06	22.26
2.60	16.74	10.07	12.46	23.42
2.80	17.97	11.32	13.90	24.62
3.00	19.22	12.58	15.35	25.86
3.20	20.48	13.84	16.81	27.12
3.40	21.74	15.09	18.27	28.39
3.60	23.00	16.35	19.74	29.65
3.80	24.25	17.60	21.19	30.90
4.00	25.50	18.85	22.63	32.14
4.20	26.73	20.10	24.06	33.36
4.40	27.95	21.34	25.48	34.57
4.60	29.16	22.58	26.88	35.75
4.80	30.36	23.80	28.27	36.92
5.00	31.55	25.01	29.64	38.08
5.20	32.72	26.20	31.00	39.23

ETHAFOAM-2

18.0 IN. D.H.

4.0 IN. THICK

-20.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	212.99	191.74	193.03	234.25
.10	144.28	123.39	128.43	165.16
.15	110.54	90.01	97.07	131.07
.20	89.50	69.31	77.70	109.68
.25	74.83	54.98	64.32	94.67
.30	63.91	44.40	54.46	83.43
.35	55.44	36.25	46.87	74.63
.40	48.66	29.78	40.85	67.54
.45	43.10	24.53	35.97	61.68
.50	38.47	20.19	31.94	56.76
.55	34.57	16.57	28.57	52.56
.60	31.23	13.51	25.72	48.95
.65	28.35	10.90	23.30	45.80
.70	25.85	8.66	21.22	43.05
.75	23.67	6.73	19.42	40.62
.80	21.76	5.05	17.87	38.46
.85	20.07	3.59	16.52	36.54
.90	18.57	2.32	15.35	34.82
.95	17.24	1.20	14.32	33.28
1.00	16.06	.23	13.43	31.90
1.20	12.48	- -	** 10.86	27.59
1.40	10.21	- -	** 9.44	24.72
1.60	8.79	- -	** 8.77	22.84
1.80	7.98	- -	** 8.60	21.67
2.00	7.59	- -	** 8.79	21.03
2.20	7.51	- -	** 9.24	20.78
2.40	7.67	- -	** 9.87	20.84
2.60	8.02	- -	** 10.65	21.13
2.80	8.50	- -	** 11.54	21.59
3.00	9.09	- -	** 12.51	22.19
3.20	9.77	- -	** 13.54	22.88
3.40	10.52	- -	14.62	23.65
3.60	11.32	- -	15.73	24.46
3.80	12.17	- -	16.87	25.31
4.00	13.05	- -	18.03	26.18
4.20	13.96	.87	19.20	27.06
4.40	14.90	1.84	20.38	27.95
4.60	15.84	2.84	21.57	28.85
4.80	16.81	3.86	22.76	29.76
5.00	17.78	4.88	23.95	30.68
5.20	18.76	5.89	25.14	31.62



ETHAFOAM-2

18.0 IN. D.H.

1.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	107.67	75.79	** 124.41	139.55
.10	64.15	32.83	** 76.85	95.47
.15	47.25	16.47	** 57.96	78.02
.20	39.08	8.84	** 48.54	69.32
.25	34.94	5.22	** 43.52	64.66
.30	32.97	3.76	** 40.90	62.19
.35	32.31	3.58	** 39.72	61.03
.40	32.47	4.22	** 39.47	60.71
.45	33.18	5.40	** 39.84	60.95
.50	34.26	6.93	** 40.64	61.59
.55	35.61	8.72	** 41.75	62.50
.60	37.15	10.68	** 43.08	63.62
.65	38.82	12.76	** 44.57	64.88
.70	40.58	14.92	** 46.18	66.25
.75	42.42	17.13	** 47.88	67.70
.80	44.30	19.38	** 49.63	69.22
.85	46.21	21.65	** 51.44	70.77
.90	48.14	23.92	** 53.28	72.37
.95	50.09	26.19	** 55.13	73.99
1.00	52.03	28.45	** 57.00	75.62
1.20	59.77	37.30	** 64.50	82.25
1.40	67.31	45.74	71.88	88.88
1.60	74.58	53.72	79.04	95.44
1.80	81.56	61.23	85.95	101.89
2.00	88.26	68.31	92.60	108.20
2.20	94.68	74.99	99.00	114.37
2.40	100.85	81.31	105.16	120.39
2.60	106.78	87.31	111.10	126.24
2.80	112.49	93.05	116.82	131.93
3.00	118.00	98.54	122.35	137.45
3.20	123.31	103.84	127.69	142.79
3.40	128.45	108.95	132.86	147.96
3.60	133.43	113.91	137.87	152.95
3.80	138.25	118.73	142.73	157.77
4.00	142.93	123.43	147.45	162.42
4.20	147.47	128.02	152.03	166.92
4.40	151.89	132.50	156.49	171.27
4.60	156.19	136.88	160.84	175.49
4.80	160.37	141.15	165.07	179.60
5.00	164.45	145.30	169.20	183.60
5.20	168.43	149.33	173.22	187.53

ETHAFOAM-2

24.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	240.88	205.73	** 215.08	276.02
.10	144.40	109.89	** 129.30	178.92
.15	102.89	69.00	** 93.13	136.79
.20	80.12	46.83	** 73.74	113.41
.25	66.28	33.58	** 62.29	98.98
.30	57.44	25.32	** 55.26	89.56
.35	51.71	20.15	** 50.95	83.27
.40	48.03	17.02	** 48.42	79.04
.45	45.78	15.31	** 47.12	76.26
.50	44.55	14.60	** 46.70	74.51
.55	44.09	14.63	** 46.92	73.54
.60	44.19	15.23	** 47.62	73.15
.65	44.73	16.25	** 48.69	73.22
.70	45.62	17.59	** 50.03	73.64
.75	46.77	19.20	** 51.59	74.35
.80	48.14	21.00	** 53.33	75.28
.85	49.68	22.96	** 55.19	76.41
.90	51.36	25.04	** 57.17	77.68
.95	53.15	27.21	** 59.22	79.08
1.00	55.03	29.46	** 61.34	80.59
1.20	63.13	38.92	** 70.21	87.34
1.40	71.72	48.63	** 79.35	94.80
1.60	80.44	58.26	88.47	102.62
1.80	89.13	67.66	97.44	110.60
2.00	97.69	76.75	106.21	118.64
2.20	106.08	85.51	114.75	126.65
2.40	114.26	93.94	123.04	134.58
2.60	122.24	102.06	131.08	142.42
2.80	130.01	109.91	138.89	150.11
3.00	137.57	117.49	146.48	157.65
3.20	144.94	124.85	153.84	165.02
3.40	152.11	132.00	160.99	172.21
3.60	159.10	138.98	167.95	179.22
3.80	165.91	145.78	174.72	186.03
4.00	172.55	152.44	181.32	192.66
4.20	179.03	158.96	187.74	199.11
4.40	185.36	165.34	194.01	205.38
4.60	191.54	171.60	200.12	211.49
4.80	197.59	177.72	206.09	217.46
5.00	203.50	183.71	211.93	223.29
5.20	209.28	189.55	217.63	229.02

ETHAFOAM-2

24.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	83.37	59.89	**	67.75	106.86
.10	53.35	30.30	**	45.78	76.40
.15	41.17	18.55	**	37.26	63.80
.20	34.95	12.74	**	33.15	57.16
.25	31.50	9.69	**	31.08	53.30
.30	29.57	8.17	**	30.10	50.98
.35	28.57	7.55	**	29.78	49.60
.40	28.17	7.53	**	29.87	48.82
.45	28.18	7.90	**	30.24	48.46
.50	28.47	8.54	**	30.80	48.39
.55	28.96	9.38	**	31.49	48.53
.60	29.60	10.36	**	32.28	48.84
.65	30.35	11.44	**	33.13	49.26
.70	31.18	12.59	**	34.04	49.78
.75	32.08	13.79	**	34.97	50.37
.80	33.02	15.03	**	35.93	51.02
.85	34.00	16.29	**	36.90	51.71
.90	35.00	17.57	**	37.89	52.43
.95	36.02	18.85	**	38.88	53.19
1.00	37.06	20.14	**	39.87	53.97
1.20	41.25	25.25	**	43.80	57.24
1.40	45.42	30.19	**	47.64	60.65
1.60	49.49	34.88		51.33	64.11
1.80	53.45	39.31		54.88	67.59
2.00	57.27	43.48		58.28	71.06
2.20	60.96	47.42		61.54	74.50
2.40	64.52	51.14		64.67	77.90
2.60	67.95	54.66		67.68	81.24
2.80	71.27	58.03		70.58	84.52
3.00	74.48	61.25		73.38	87.72
3.20	77.59	64.35		76.08	90.83
3.40	80.60	67.35		78.68	93.85
3.60	83.52	70.26		81.21	96.78
3.80	86.35	73.10		83.66	99.61
4.00	89.11	75.87		86.03	102.35
4.20	91.79	78.57		88.33	105.00
4.40	94.40	81.22		90.58	107.57
4.60	96.94	83.82		92.76	110.06
4.80	99.41	86.35		94.88	112.48
5.00	101.83	88.81		96.95	114.85
5.20	104.10	91.20		98.97	117.19

ETHAFOAM-2      30.0 IN. D.H.      4.0 IN. THICK      -65.0 TEMPERATURE

STATIC STRESS

DECELERATION (G)

PSI	IDCC	LOWFR-P	MODEL	UPPER-P
.05	289.83	205.19	283.90	314.46
.10	196.00	171.81	191.27	220.19
.15	150.06	126.31	146.03	173.82
.20	121.48	98.14	117.94	144.81
.25	101.59	78.67	98.44	124.52
.30	86.83	64.31	83.99	109.35
.35	75.39	53.26	72.81	97.52
.40	66.25	44.51	63.90	88.00
.45	58.79	37.42	56.64	80.16
.50	52.58	31.58	50.61	73.59
.55	47.35	26.70	45.54	68.01
.60	42.90	22.59	41.23	63.21
.65	39.07	19.09	37.54	59.04
.70	35.75	16.10	34.35	55.40
.75	32.86	13.52	31.57	52.20
.80	30.33	11.30	29.15	49.37
.85	28.11	9.37	27.03	46.85
.90	26.15	7.69	25.17	44.60
.95	24.41	6.23	23.52	42.59
1.00	22.87	4.96	** 22.07	40.79
1.20	18.27	1.30	** 17.77	35.23
1.40	15.41	- -	** 15.18	31.58
1.60	13.71	- -	** 13.70	29.22
1.80	12.81	- -	** 12.99	27.80
2.00	12.47	- -	** 12.83	27.07
2.20	12.55	- -	** 13.07	26.87
2.40	12.94	- -	** 13.61	27.07
2.60	13.56	- -	** 14.37	27.57
2.80	14.37	.43	** 15.30	28.31
3.00	15.33	1.42	** 16.37	29.24
3.20	16.39	2.49	17.54	30.29
3.40	17.54	3.64	18.80	31.44
3.60	18.77	4.86	20.11	32.67
3.80	20.04	6.14	21.48	33.94
4.00	21.36	7.48	22.89	35.24
4.20	22.71	8.86	24.32	36.56
4.40	24.09	10.29	25.78	37.90
4.60	25.49	11.74	27.25	39.25
4.80	26.91	13.21	28.73	40.60
5.00	28.33	14.69	30.23	41.97
5.20	29.76	16.16	31.72	43.36



ETHAFOAM-2

30.0 IN. U.H.

1.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI	INCC	DECELERATION (G)	MODFL	UPPER-P
		LOWER-P		
.05	108.94	65.69	** 95.35	152.19
.10	82.21	39.72	** 71.68	124.71
.15	76.15	34.40	** 67.32	117.90
.20	76.13	35.10	** 68.47	117.15
.25	78.56	38.24	** 71.79	118.88
.30	82.13	42.50	** 76.08	121.77
.35	86.27	47.30	** 80.81	125.24
.40	90.68	52.36	** 85.73	129.00
.45	95.20	57.52	** 90.69	132.89
.50	99.75	62.68	** 95.63	136.83
.55	104.28	67.80	** 100.51	140.77
.60	108.76	72.85	** 105.30	144.67
.65	113.16	77.81	** 110.00	148.52
.70	117.49	82.67	** 114.58	152.30
.75	121.72	87.42	** 119.06	156.02
.80	125.87	92.07	** 123.44	159.67
.85	129.93	96.61	** 127.71	163.25
.90	133.90	101.04	** 131.88	166.77
.95	137.79	105.37	** 135.95	170.21
1.00	141.59	109.59	** 139.93	173.59
1.20	156.03	125.53	** 154.98	186.52
1.40	169.34	140.08	168.81	198.61
1.60	181.70	153.40	181.61	210.01
1.80	193.24	165.66	193.53	220.82
2.00	204.07	177.01	204.69	231.13
2.20	214.27	187.56	215.20	240.99
2.40	223.93	197.42	225.13	250.44
2.60	233.10	206.69	234.54	259.51
2.80	241.84	215.46	243.51	268.22
3.00	250.18	223.79	252.06	276.57
3.20	258.18	231.75	260.25	284.60
3.40	265.85	239.39	268.10	292.30
3.60	273.22	246.74	275.64	299.70
3.80	280.33	253.85	282.91	306.81
4.00	287.19	260.74	289.91	313.64
4.20	293.81	267.42	296.68	320.20
4.40	300.23	273.93	303.23	326.53
4.60	306.45	280.25	309.58	332.65
4.80	312.48	286.39	315.73	338.57
5.00	318.34	292.34	321.70	344.33
5.20	324.03	298.10	327.51	349.97

SECTION III  
POLYETHYLENE FOAM  
DOW ETHAFOAM (4 Lb./Ft.<sup>3</sup>)

## ETHAFOAM 4 MODEL VALIDATION

MICOM Report No. RL-CR-75-4 [3] developed individual dynamic cushioning curves, 61 out of 72 being statistically significant at an alpha level of .05. The majority of the statistically insignificant equations occurred at the low temperature extremes and a 4" cushion thickness, where an inflection in the design curve could not occur due to stress level limitations associated with the experimental equipment.

The model validation for Ethafoam 4 followed the same procedure developed for the Minicel material. Table 3 presents the coefficients and variables for the Ethafoam 4 model.

Seventy two different combinations of drop height, temperature, and cushion thickness were evaluated. Three of these combinations could not achieve the criteria established for model validation. On page 75, it is noted that the first case contains only one point which is outside the prediction limits for the significant portion of the design curve. This case is similar to the 8 cases associated with Ethafoam 2; the static stress level is .05 psi, and is well removed from the minimum model G value. Consequently, it is not considered to effect the model validation in a significant fashion. The remaining two cases are much more important, since *the deviant points are of a similar magnitude to the model minimum value*. However, sufficient points are within the prediction limits to permit use of the model at the minimum G-level.

The remaining 69 combinations were all acceptable based upon the established validation criteria. In addition, 52 of the 69 remaining combinations were within the prediction limits for the entire static stress range considered. Selected samples of these combinations are shown on pages 78 through 85.

TABLE 3  
ETHAFOAM 4 MODEL

Variable	Coefficient	$\theta$	$\theta^2$	$\theta^3$	$h^{1/2}$	$T^{-1/2}$	$T^{-3/2}$	$(\ln \sigma_s)$	$(\ln \sigma_s)^2$
0	32.918823								
1	-48.167497	X				X			
2	0.0	X				X		X	
3	0.0	X				X			X
4	0.0	X			X		X		
5	-41.636209	X			X		X	X	
6	6.0138922	X			X		X		X
7	216.47001	X			X	X			
8	-33.446350	X			X	X		X	
9	0.0	X			X	X			X
10	0.0		X			X			
11	4.3098396		X			X		X	
12	0.0		X			X			X
13	0.0		X		X		X		
14	9.4729454		X		X		X	X	
15	-1.0063034		X		X		X		X
16	-51.701093		X		X	X			
17	3.6087819		X		X	X		X	
18	0.55314362		X		X	X			X
19	0.0			X		X			
20	0.0			X		X		X	
21	-0.10103962			X		X			X
22	-0.21961366			X	X		X		
23	-0.30423020			X	X		X	X	
24	0.0			X	X		X		X
25	3.2311604			X	X	X			
26	0.0			X	X	X		X	
27	-0.054746082			X	X	X			X
28	-253.15151	X					X		
29	136.40772	X					X	X	
30	-11.80598	X					X		X
31	72.15674		X				X		
32	-25.154675		X				X	X	
33	0.0		X				X		X
34	-4.1437095			X			X		
35	0.0			X			X	X	
36	0.357168			X			X		X



ETHAFUAM-4

24.0 IN. D.H.

2.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	125.49	105.13	** 152.94 *	145.85
.10	80.97	61.03	** 96.38	100.91
.15	60.83	41.31	** 70.48	80.36
.20	49.19	30.08	** 55.31	68.31
.25	41.67	22.96	** 45.39	60.38
.30	36.51	18.19	** 38.47	54.83
.35	32.83	14.90	** 33.46	50.76
.40	30.15	12.61	** 29.73	47.70
.45	28.18	11.02	** 26.93	45.35
.50	26.73	9.94	** 24.80	43.53
.55	25.68	9.24	** 23.18	42.11
.60	24.92	8.84	** 21.95	41.00
.65	24.41	8.68	** 21.04	40.13
.70	24.08	8.69	** 20.38	39.46
.75	23.90	8.85	** 19.93	38.95
.80	23.86	9.14	** 19.65	38.58
.85	23.91	9.51	** 19.50	38.31
.90	24.05	9.97	** 19.47	38.13
.95	24.27	10.49	** 19.54	38.04
1.00	24.54	11.07	** 19.69	38.01
1.20	26.08	13.74	** 20.92	38.41
1.40	28.07	16.75	** 22.80	39.39
1.60	30.30	19.88	** 25.05	40.72
1.80	32.66	23.01	** 27.50	42.31
2.00	35.09	26.08	30.08	44.09
2.20	37.53	29.06	32.72	46.01
2.40	39.98	31.91	35.39	48.04
2.60	42.40	34.65	38.05	50.15
2.80	44.80	37.26	40.71	52.33
3.00	47.16	39.77	43.34	54.55
3.20	49.49	42.18	45.94	56.79
3.40	51.77	44.51	48.50	59.03
3.60	54.01	46.77	51.03	61.26
3.80	56.21	48.97	53.51	63.45
4.00	58.37	51.14	55.96	65.61
4.20	60.49	53.26	58.36	67.72
4.40	62.57	55.35	60.73	69.79
4.60	64.61	57.42	63.05	71.81
4.80	66.61	59.45	65.34	73.78
5.00	68.58	61.45	67.59	75.71
5.20	70.51	63.41	69.80	77.61

ETHAFUAM-4

18.0 IN. D.H.

4.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWFR-P	MODEL		UPPER-P
.05	150.85	142.26	139.17	*	159.44
.10	106.37	97.95	96.98	*	114.78
.15	84.25	76.01	76.23		92.49
.20	70.31	62.24	63.28		78.38
.25	60.49	52.59	54.24		68.39
.30	53.12	45.39	47.51		60.86
.35	47.34	39.77	42.28		54.91
.40	42.67	35.26	38.09		50.09
.45	38.82	31.56	34.65		46.07
.50	35.57	28.47	31.79		42.67
.55	32.80	25.86	29.36		39.75
.60	30.41	23.62	27.29		37.21
.65	28.33	21.68	25.51		34.98
.70	26.51	20.00	23.95		33.01
.75	24.90	18.53	22.59		31.26
.80	23.46	17.24	21.40		29.69
.85	22.18	16.09	20.34		28.27
.90	21.04	15.08	19.41		26.99
.95	20.00	14.17	18.57		25.83
1.00	19.07	13.37	17.83		24.77
1.20	16.13	10.90	15.57		21.36
1.40	14.10	9.29	14.12		18.90
1.60	12.67	8.24	13.21		17.10
1.80	11.68	7.57	** 12.66		15.78
2.00	10.99	7.15	** 12.38		14.83
2.20	10.54	6.92	** 12.30		14.16
2.40	10.26	6.82	** 12.36		13.71
2.60	10.13	6.81	** 12.54		13.45
2.80	10.11	6.88	** 12.80		13.33
3.00	10.17	7.00	** 13.13		13.34
3.20	10.30	7.17	** 13.52	*	13.44
3.40	10.50	7.38	** 13.95	*	13.61
3.60	10.74	7.63	** 14.42	*	13.85
3.80	11.02	7.92	** 14.91	*	14.12
4.00	11.33	8.23	15.43	*	14.44
4.20	11.68	8.57	15.97	*	14.78
4.40	12.04	8.95	16.52	*	15.13
4.60	12.42	9.34	17.08	*	15.51
4.80	12.82	9.75	17.65	*	15.89
5.00	13.24	10.18	18.22	*	16.29
5.20	13.66	10.62	18.80	*	16.70

ETHAFOAM-4

24.0 IN. D.H.

4.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION (G) LOWER-P	MODEL	UPPER-P
.05	175.12	163.63	161.84 *	186.62
.10	121.44	110.18	110.02 *	132.69
.15	94.99	83.96	84.86	106.01
.20	78.44	67.64	69.32	89.23
.25	66.87	56.30	58.58	77.44
.30	58.23	47.89	50.66	68.58
.35	51.51	41.38	44.57	61.64
.40	46.12	36.20	39.73	56.03
.45	41.69	31.99	35.81	51.39
.50	37.99	28.49	32.57	47.48
.55	34.85	25.56	29.86	44.15
.60	32.17	23.07	27.57	41.26
.65	29.85	20.95	25.62	38.74
.70	27.82	19.12	23.95	36.53
.75	26.05	17.53	22.51	34.56
.80	24.49	16.15	21.26	32.82
.85	23.10	14.95	20.17	31.25
.90	21.87	13.90	19.22	29.85
.95	20.78	12.97	18.40	28.58
1.00	19.80	12.16	17.68	27.43
1.20	16.78	9.79	15.60	23.78
1.40	14.82	8.39	** 14.45	21.24
1.60	13.54	7.61	** 13.90	19.46
1.80	12.74	7.24	** 13.76	18.24
2.00	12.29	7.15	** 13.90	17.42
2.20	12.09	7.25	** 14.25	16.93
2.40	12.09	7.48	** 14.75	16.70
2.60	12.23	7.79	** 15.37	16.67
2.80	12.49	8.18	** 16.07	16.81
3.00	12.85	8.61	** 16.84	17.08
3.20	13.27	9.08	** 17.66 *	17.46
3.40	13.76	9.59	** 18.52 *	17.92
3.60	14.29	10.13	19.40 *	18.45
3.80	14.86	10.71	20.31 *	19.01
4.00	15.46	11.31	21.24 *	19.61
4.20	16.09	11.94	22.17 *	20.24
4.40	16.73	12.59	23.11 *	20.87
4.60	17.40	13.27	24.06 *	21.52
4.80	18.07	13.96	25.01 *	22.18
5.00	18.76	14.67	25.96 *	22.84
5.20	19.45	15.38	26.91 *	23.52



ETHAFUAM-4      12.0 IN. D.H.      1.0 IN. THICK      -65.0 TEMPERATURE

STATIC STRESS		DECELERATION (G)		
PSI	IDCC	LOWER-P	MODFL	UPPER-P
.05	263.60	200.45	284.11	326.75
.10	195.25	133.30	204.89	257.21
.15	160.64	99.87	165.24	221.41
.20	138.48	78.87	140.10	198.09
.25	122.67	64.21	122.32	181.14
.30	110.64	53.30	108.89	167.98
.35	101.10	44.87	98.33	157.33
.40	93.29	38.15	89.75	148.44
.45	86.76	32.69	82.63	140.84
.50	81.21	28.19	76.61	134.23
.55	76.41	24.42	71.45	128.40
.60	72.22	21.25	66.99	123.20
.65	68.53	18.56	63.08	118.51
.70	65.25	16.25	59.63	114.26
.75	62.32	14.28	56.57	110.36
.80	59.68	12.57	53.83	106.79
.85	57.29	11.10	51.38	103.48
.90	55.12	9.83	49.16	100.41
.95	53.14	8.72	47.16	97.55
1.00	51.32	7.77	45.34	94.88
1.20	45.38	5.06	39.51	85.71
1.40	40.99	3.57	35.37	78.41
1.60	37.64	2.79	32.35	72.50
1.80	35.05	2.42	30.14	67.68
2.00	33.01	2.27	28.51	63.76
2.20	31.40	2.22	27.32	60.58
2.40	30.12	2.19	26.48	58.05
2.60	29.11	2.15	25.90	56.06
2.80	28.30	2.06	25.54	54.54
3.00	27.67	1.93	25.35	53.41
3.20	27.19	1.78	** 25.31	52.60
3.40	26.82	1.61	** 25.38	52.03
3.60	26.56	1.46	** 25.55	51.66
3.80	26.39	1.33	** 25.79	51.44
4.00	26.28	1.25	** 26.11	51.32
4.20	26.25	1.23	** 26.49	51.27
4.40	26.26	1.26	** 26.91	51.27
4.60	26.33	1.37	** 27.38	51.29
4.80	26.44	1.54	** 27.88	51.34
5.00	26.58	1.76	** 28.41	51.40
5.20	26.76	2.03	** 28.97	51.49



ETHAFUAM-4

12.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	151.19	133.79	138.95	168.59
.10	101.58	84.53	96.96	118.63
.15	77.53	60.82	76.15	94.23
.20	62.68	46.32	63.07	79.04
.25	52.44	36.41	53.88	68.46
.30	44.89	29.20	47.01	60.58
.35	39.09	23.72	41.63	54.46
.40	34.49	19.44	37.29	49.54
.45	30.77	16.03	33.72	45.50
.50	27.70	13.27	30.72	42.13
.55	25.13	11.00	28.17	39.26
.60	22.97	9.14	25.97	36.80
.65	21.13	7.58	24.07	34.67
.70	19.55	6.29	22.40	32.81
.75	18.19	5.21	20.93	31.17
.80	17.01	4.30	** 19.63	29.73
.85	16.00	3.55	** 18.47	28.45
.90	15.11	2.92	** 17.43	27.30
.95	14.34	2.40	** 16.50	26.28
1.00	13.67	1.97	** 15.67	25.36
1.20	11.76	.97	** 13.05	22.54
1.40	10.72	.74	** 11.28	20.69
1.60	10.25	.97	** 10.07	19.52
1.80	10.16	1.48	** 9.25	18.84
2.00	10.35	2.15	** 8.72	18.55
2.20	10.73	2.91	** 8.40	18.54
2.40	11.25	3.73	** 8.24	18.78
2.60	11.89	4.57	** 8.21	19.20
2.80	12.60	5.42	** 8.28	19.77
3.00	13.37	6.28	8.42	20.46
3.20	14.19	7.15	8.63	21.23
3.40	15.04	8.02	8.89	22.07
3.60	15.92	8.90	9.19	22.95
3.80	16.82	9.80	9.52	* 23.85
4.00	17.74	10.71	9.89	* 24.76
4.20	18.66	11.64	10.28	* 25.68
4.40	19.59	12.58	10.68	* 26.60
4.60	20.53	13.54	11.11	* 27.51
4.80	21.46	14.50	11.54	* 28.42
5.00	22.40	15.47	11.99	* 29.32
5.20	23.33	16.43	12.45	* 30.23

ETHAFUAM-4      18.0 IN. D.H.      4.0 IN. THICK      -20.0 TEMPERATURE

STATIC STRESS		DECCELERATION (G)		
PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	206.66	175.57	221.66	237.74
.10	160.20	129.79	164.59	190.80
.15	135.92	105.98	135.44	165.87
.20	119.86	90.48	116.65	149.25
.25	108.11	79.27	103.16	136.95
.30	98.96	70.66	92.84	127.26
.35	91.55	63.78	84.61	119.32
.40	85.36	58.11	77.84	112.62
.45	80.09	53.34	72.15	106.84
.50	75.52	49.27	67.29	101.77
.55	71.50	45.74	63.07	97.26
.60	67.93	42.65	59.37	93.21
.65	64.73	39.92	56.09	89.54
.70	61.84	37.49	53.17	86.19
.75	59.21	35.30	50.54	83.11
.80	56.80	33.33	48.16	80.26
.85	54.58	31.55	45.99	77.62
.90	52.53	29.92	44.02	75.15
.95	50.63	28.42	42.21	72.84
1.00	48.86	27.05	40.54	70.67
1.20	42.84	22.51	35.02	63.16
1.40	38.06	19.05	30.85	57.07
1.60	34.16	16.29	27.60	52.03
1.80	30.91	14.01	25.01	47.80
2.00	28.14	12.05	22.92	44.22
2.20	25.75	10.32	21.21	41.19
2.40	23.67	8.74	19.80	38.60
2.60	21.84	7.29	18.63	36.39
2.80	20.21	5.94	17.66	34.49
3.00	18.76	4.66	16.85	32.86
3.20	17.46	3.47	16.17	31.45
3.40	16.28	2.35	15.60	30.21
3.60	15.21	1.30	15.13	29.11
3.80	14.23	.34	14.75	28.13
4.00	13.34	- -	14.43	27.24
4.20	12.53	- -	** 14.18	26.42
4.40	11.77	- -	** 13.98	25.65
4.60	11.08	- -	** 13.82	24.93
4.80	10.44	- -	** 13.71	24.25
5.00	9.84	- -	** 13.64	23.60
5.20	9.29	- -	** 13.60	23.00

ETHAFUAM-4

18.0 IN. D.H.

1.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	149.62	128.93	**	156.51	170.30
.10	96.20	75.95	**	97.44	116.45
.15	72.61	52.78	**	71.69	92.44
.20	59.30	39.89	**	57.36	78.71
.25	50.94	31.94	**	48.49	69.94
.30	45.38	26.78	**	42.71	63.97
.35	41.57	23.37	**	38.84	59.76
.40	38.93	21.12	**	36.25	56.73
.45	37.11	19.68	**	34.55	54.53
.50	35.88	18.84	**	33.50	52.93
.55	35.11	18.43	**	32.92	51.78
.60	34.67	18.35	**	32.70	50.99
.65	34.50	18.53	**	32.77	50.46
.70	34.53	18.92	**	33.06	50.15
.75	34.74	19.46	**	33.52	50.01
.80	35.08	20.13	**	34.13	50.02
.85	35.52	20.90	**	34.84	50.15
.90	36.06	21.76	**	35.65	50.37
.95	36.68	22.68	**	36.53	50.68
1.00	37.35	23.65	**	37.48	51.05
1.20	40.48	27.90	**	41.68	53.06
1.40	44.02	32.43	**	46.26	55.61
1.60	47.75	37.01	**	50.98	58.48
1.80	51.54	41.53		55.73	61.56
2.00	55.34	45.92		60.44	64.77
2.20	59.11	50.15		65.08	68.07
2.40	62.82	54.21		69.64	71.43
2.60	66.46	58.10		74.09	74.83
2.80	70.03	61.83		78.43	78.24
3.00	73.53	65.42		82.67	81.64
3.20	76.94	68.88		86.81	85.01
3.40	80.28	72.23		90.85	88.34
3.60	83.55	75.49		94.79	91.60
3.80	86.74	78.67		98.63	94.80
4.00	89.86	81.79		102.39	97.93
4.20	92.91	84.84		106.05	100.98
4.40	95.90	87.85		109.64	103.95
4.60	98.82	90.79		113.14	106.85
4.80	101.68	93.69		116.57	109.67
5.00	104.49	96.53		119.93	112.44
5.20	107.23	99.31		123.21	115.16



ETHAFUAM-4

24.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	268.65	216.55	** 300.33	320.74
.10	172.37	121.36	** 189.09	223.38
.15	128.25	78.31	** 138.25	178.20
.20	102.41	53.51	** 108.56	151.31
.25	85.48	37.61	** 89.18	133.35
.30	73.68	26.81	** 75.71	120.54
.35	65.11	19.24	** 65.97	110.98
.40	58.75	13.85	** 58.77	103.64
.45	53.94	10.01	** 53.36	97.88
.50	50.29	7.29	** 49.28	93.29
.55	47.51	5.43	** 46.19	89.59
.60	45.40	4.23	** 43.89	86.58
.65	43.83	3.54	** 42.19	84.13
.70	42.69	3.26	** 40.98	82.12
.75	41.90	3.32	** 40.18	80.48
.80	41.40	3.64	** 39.70	79.15
.85	41.13	4.18	** 39.49	78.08
.90	41.06	4.90	** 39.51	77.22
.95	41.16	5.77	** 39.73	76.56
1.00	41.41	6.76	** 40.10	76.05
1.20	43.44	11.59	** 42.79	75.29
1.40	46.58	17.19	** 46.72	75.96
1.60	50.35	23.09	** 51.36	77.60
1.80	54.48	29.03	** 56.39	79.94
2.00	58.83	34.84	61.65	82.81
2.20	63.28	40.45	67.02	86.11
2.40	67.78	45.82	72.42	89.74
2.60	72.28	50.94	77.82	93.63
2.80	76.77	55.84	83.19	97.70
3.00	81.21	60.53	88.50	101.90
3.20	85.61	65.04	93.74	106.17
3.40	89.94	69.42	98.91	110.46
3.60	94.21	73.70	104.00	114.73
3.80	98.42	77.89	109.00	118.94
4.00	102.56	82.03	113.93	123.09
4.20	106.62	86.11	118.76	127.14
4.40	110.63	90.16	123.52	131.09
4.60	114.56	94.16	128.19	134.95
4.80	118.43	98.12	132.78	138.73
5.00	122.23	102.02	137.29	142.44
5.20	125.97	105.83	141.73	146.11



ETHAFUAM-4

24.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	103.10	60.32	** 102.88	145.89
.10	62.40	20.58	** 64.72	104.39
.15	45.22	4.18	** 48.24	86.26
.20	35.88	- -	** 39.15	76.06
.25	30.20	- -	** 33.60	69.63
.30	26.80	- -	** 30.03	65.32
.35	24.61	- -	** 27.69	62.32
.40	23.27	- -	** 26.17	60.18
.45	22.52	- -	** 25.21	58.65
.50	22.10	- -	** 24.67	57.55
.55	22.17	- -	** 24.42	56.78
.60	22.38	- -	** 24.41	56.26
.65	22.77	- -	** 24.57	55.93
.70	23.30	- -	** 24.87	55.76
.75	23.94	- -	** 25.28	55.70
.80	24.66	- -	** 25.77	55.75
.85	25.45	- -	** 26.34	55.88
.90	26.20	- -	** 26.96	56.08
.95	27.17	- -	** 27.62	56.33
1.00	28.09	- -	** 28.32	56.64
1.20	31.97	5.70	** 31.37	58.23
1.40	36.00	11.75	** 34.63	60.25
1.60	40.06	17.55	37.96	62.57
1.80	44.07	23.03	41.28	65.10
2.00	47.90	28.16	44.56	67.83
2.20	51.83	32.94	47.78	70.71
2.40	55.56	37.39	50.02	73.72
2.60	59.18	41.52	53.99	76.84
2.80	62.70	45.38	56.98	80.02
3.00	66.13	49.01	59.90	83.24
3.20	69.46	52.45	62.73	86.47
3.40	72.60	55.72	65.50	89.66
3.60	75.84	58.88	68.19	92.81
3.80	78.91	61.93	70.82	95.89
4.00	81.90	64.92	73.39	98.88
4.20	84.81	67.85	75.89	101.78
4.40	87.66	70.72	78.33	104.59
4.60	90.43	73.56	80.72	107.31
4.80	93.14	76.34	83.06	109.95
5.00	95.80	79.07	85.34	112.52
5.20	98.39	81.73	87.58	115.04

ETHAFUAM-4

30.0 IN. D.H.

4.0 IN. THICK

-65.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	INCC	LOWER-P	MODEL	UPPER-P
.05	377.10	318.66	339.97	435.55
.10	283.22	225.87	254.04	340.57
.15	234.78	178.51	209.87	291.06
.20	203.31	148.10	181.27	258.53
.25	180.56	126.39	160.64	234.74
.30	163.05	109.90	144.79	216.20
.35	148.90	96.85	132.11	201.13
.40	137.38	86.23	121.64	188.52
.45	127.56	77.39	112.82	177.73
.50	119.12	69.91	105.25	168.34
.55	111.77	63.49	98.66	160.04
.60	105.28	57.93	92.86	152.63
.65	99.51	53.07	87.72	145.95
.70	94.34	48.78	83.10	139.89
.75	89.66	44.98	78.95	134.34
.80	85.41	41.58	75.17	129.24
.85	81.53	38.54	71.74	124.52
.90	77.97	35.80	68.59	120.14
.95	74.69	33.31	65.69	116.06
1.00	71.66	31.06	63.01	112.25
1.20	61.40	23.84	54.09	99.14
1.40	53.65	18.64	47.25	88.66
1.60	47.42	14.74	41.86	80.10
1.80	42.35	11.70	37.51	73.00
2.00	38.16	9.23	33.93	67.09
2.20	34.65	7.14	30.96	62.15
2.40	31.67	5.31	28.47	58.03
2.60	29.13	3.65	26.36	54.60
2.80	26.94	2.12	24.56	51.76
3.00	25.04	.69	23.02	49.39
3.20	23.40	-	21.70	47.44
3.40	21.96	-	20.56	45.81
3.60	20.70	-	19.58	44.45
3.80	19.60	-	18.73	43.30
4.00	18.64	-	18.01	42.31
4.20	17.79	-	** 17.38	41.45
4.40	17.05	-	** 16.85	40.68
4.60	16.30	-	** 16.39	39.99
4.80	15.82	-	** 16.00	39.36
5.00	15.33	-	** 15.68	38.79
5.20	14.80	-	** 15.41	38.27

ETHAFUAM-4

30.0 IN. D.H.

1.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	IDCC	LOWFR-P	MODEL	UPPER-P
.05	151.17	101.12	** 140.25	201.21
.10	94.27	45.26	** 90.49	143.28
.15	73.26	25.27	** 72.44	121.25
.20	63.85	16.86	** 64.58	110.83
.25	59.68	13.69	** 61.32	105.68
.30	58.32	13.30	** 60.48	103.35
.35	58.60	14.53	** 61.07	102.67
.40	59.90	16.76	** 62.53	103.03
.45	61.86	19.64	** 64.55	104.07
.50	64.26	22.94	** 66.94	105.57
.55	66.96	26.53	** 69.58	107.39
.60	69.86	30.30	** 72.38	109.42
.65	72.90	34.18	** 75.29	111.61
.70	76.02	38.14	** 78.27	113.91
.75	79.20	42.13	** 81.29	116.28
.80	82.42	46.14	** 84.32	118.70
.85	85.65	50.15	** 87.36	121.15
.90	88.88	54.13	** 90.40	123.62
.95	92.10	58.09	** 93.42	126.11
1.00	95.30	62.02	** 96.42	128.59
1.20	107.87	77.26	** 108.13	138.47
1.40	119.92	91.69	119.32	148.15
1.60	131.42	105.23	129.97	157.60
1.80	142.37	117.92	140.10	166.83
2.00	152.82	129.78	149.74	175.87
2.20	162.80	140.87	158.94	184.74
2.40	172.35	151.26	167.73	193.45
2.60	181.50	161.00	176.15	202.00
2.80	190.29	170.18	184.23	210.40
3.00	198.74	178.87	192.00	218.62
3.20	206.89	187.13	199.47	226.64
3.40	214.75	195.04	206.69	234.46
3.60	222.34	202.64	213.66	242.05
3.80	229.70	209.98	220.40	249.42
4.00	236.82	217.09	226.93	256.54
4.20	243.73	224.02	233.26	263.44
4.40	250.44	230.77	239.40	270.11
4.60	256.96	237.36	245.38	276.56
4.80	263.31	243.79	251.19	282.83
5.00	269.49	250.06	256.85	288.92
5.20	275.52	256.15	262.36	294.88

SECTION IV  
POLYESTER URETHANE  
(4 Lb./Ft.<sup>3</sup>)



## URESTER 4 MODEL VALIDATION

MICOM Report No. RL-CR-75-1 [2] developed individual dynamic cushioning curves, 52 out of 60 being statistically significant at an alpha level of .05. It should be noted that this cushioning material is not considered adequate below  $-20^{\circ}\text{F}$ . In particular, in drop testing at  $-65^{\circ}\text{F}$ , a minimum G-level reading at impact was not found even when the static stress conditions were set at 10 psi, which is twice the normal maximum static stress. Consequently, this portion of the report will present results at temperatures of  $-20$ ,  $20$ ,  $70$ ,  $110$ , and  $160^{\circ}\text{F}$ .

Also, at the hotter temperature ( $160^{\circ}\text{F}$ ), data collection was constrained to 3 psi or less, due to material overstressing. The developed IDCC were extrapolated beyond the data limit when shown to 5.20 psi. The extrapolated curves may not exhibit the typical cross over effects normally associated with temperature sensitive dynamic cushioning curves.

The model validation for Urester 4 followed the same procedure developed for the Minicel material. Table 4 presents the coefficients and variables for the Urester 4 model.

Sixty different combinations of drop height, temperature, and cushion thickness were evaluated. Nine of these combinations could not achieve the criteria established for model validation. On pages 90 through 93, it is noted that only one data point is outside of the prediction limit, that being at .05 psi. This is the same situation which has occurred in the Ethafoam 2 and Ethafoam 4 models. This situation has been discussed in previous sections and will not be repeated here. However, these four cases are not considered to affect the model validation. Three of the remaining five cases are similar to the first four, since the points outside of

TABLE 4  
URESTER 4 MODEL

Variable	Coefficient	$\theta$	$\theta^2$	$\theta^3$	$h^{1/2}$	$T^{-1/2}$	$T^{-3/2}$	$(\ln \sigma_s)$	$(\ln \sigma_s)^2$
0	559.746								
1	0.0	X				X			
2	0.0	X				X		X	
3	0.0	X				X			X
4	-107.90113	X			X		X		
5	32.951047	X			X		X	X	
6	-3.7757201	X			X		X		X
7	206.02943	X			X	X			
8	-49.869706	X			X	X		X	
9	-5.0392425	X			X	X			X
10	0.0		X			X			
11	0.0		X			X		X	
12	0.0		X			X			X
13	19.77191		X		X		X		
14	0.0		X		X		X	X	
15	0.0		X		X		X		X
16	-56.422906		X		X	X			
17	7.8434079		X		X	X		X	
18	3.1028043		X		X	X			X
19	0.0			X		X			
20	0.0			X		X		X	
21	0.0			X		X			X
22	0.0			X	X		X		
23	-1.0933512			X	X		X	X	
24	0.14231548			X	X		X		X
25	3.7496497			X	X	X			
26	0.0			X	X	X		X	
27	-0.30983233			X	X	X			X
28	0.0	X					X		
29	0.0	X					X	X	
30	10.179055	X					X		X
31	48.304712		X				X		
32	-51.619216		X				X	X	
33	0.0		X				X		X
34	-9.0192091			X			X		
35	5.953505			X			X	X	
36	-0.45214979			X			X		X
37	-213.604	X							
38	0.0	X						X	
39	8.2119242	X							X
40	0.0		X						
41	14.258078		X					X	
42	-5.0070270		X						X
43	3.5099545			X					
44	-2.4040742			X				X	
45	0.59891503			X					X

the prediction limits are at the lower static stress levels, but in one case there are two points, and in the other two cases, there are three.

The remaining two cases involve data points at the upper static stress level of the significant portion of the design range. The first of these two cases involves only one deviant point which is 50G's from the model minimum G-value. The final case involves a very thin cushion (1 in.) at a large drop height (30 in.). However, the minimum G-level is far removed from the model points which are outside of the prediction limit. Eight of the nine cases are observed to be at a temperature of 20°F, indicating a large random variation within the cushion samples when this temperature is reached.

The remaining 51 combinations were all acceptable based upon the established validation criteria. Thirty five of the remaining 51 combinations were within the prediction limits for the entire static stress range under consideration. Selected samples of these combinations are shown on pages 99 through 104.

AD-A032 556

ALABAMA UNIV IN HUNTSVILLE SCHOOL OF GRADUATE STUDIE--ETC F/G 13/4  
VALIDATION OF GENERALIZED CUSHIONING MODELS FOR SELECTED TEMPER--ETC(U)  
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URESTER-4

12.0 IN. D.H.

2.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION (G)

LOWER-P

MODEL

UPPER-P

.05	54.72	44.11	**	65.92	*	65.33
.10	34.18	23.75	**	43.20		44.61
.15	25.82	15.56	**	33.44		36.08
.20	21.52	11.43	**	28.10		31.61
.25	19.12	9.19	**	24.87		29.05
.30	17.77	8.00	**	22.81		27.54
.35	17.05	7.43	**	21.48		26.68
.40	16.74	7.26	**	20.63		26.22
.45	16.71	7.37	**	20.12		26.06
.50	16.88	7.67	**	19.84		26.09
.55	17.19	8.11	**	19.75		26.27
.60	17.60	8.64	**	19.79		26.56
.65	18.09	9.25	**	19.93		26.93
.70	18.64	9.90	**	20.15		27.37
.75	19.22	10.60	**	20.44		27.85
.80	19.85	11.32	**	20.77		28.37
.85	20.49	12.06	**	21.15		28.92
.90	21.16	12.82	**	21.56		29.50
.95	21.83	13.58	**	21.99		30.09
1.00	22.52	14.34	**	22.44		30.70
1.20	25.31	17.41	**	24.39		33.22
1.40	28.10	20.39	**	26.45		35.81
1.60	30.83	23.26		28.54		38.40
1.80	33.48	25.99		30.62		40.97
2.00	36.04	28.60		32.66		43.48
2.20	38.52	31.09		34.66		45.94
2.40	40.91	33.48		36.61		48.34
2.60	43.22	35.77		38.52		50.66
2.80	45.45	37.98		40.37		52.91
3.00	47.61	40.12		42.17		55.09
3.20	49.69	42.20		43.92		57.19
3.40	51.72	44.22		45.63		59.22
3.60	53.68	46.19		47.30		61.17
3.80	55.59	48.12		48.92		63.06
4.00	57.44	50.00		50.50		64.89
4.20	59.25	51.83		52.04		66.66
4.40	61.00	53.62		53.55	*	68.38
4.60	62.71	55.37		55.02	*	70.06
4.80	64.38	57.06		56.46	*	71.71
5.00	66.01	58.69		57.86	*	73.33
5.20	67.60	60.26		59.24	*	74.95

URESTER-4

24.0 IN. D.H.

4.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECLERATION LOWER-P	(G) MODEL	UPPER-P
.05	47.29	32.25	** 69.52 *	62.34
.10	30.69	15.90	** 45.39	45.48
.15	24.36	9.81	** 35.35	38.91
.20	21.38	7.07	** 30.05	35.69
.25	19.94	5.85	** 26.98	34.02
.30	19.32	5.46	** 25.15	33.18
.35	19.19	5.54	** 24.07	32.84
.40	19.37	5.93	** 23.49	32.81
.45	19.75	6.51	** 23.25	33.00
.50	20.28	7.22	** 23.25	33.33
.55	20.89	8.02	** 23.43	33.77
.60	21.58	8.87	** 23.74	34.28
.65	22.31	9.77	** 24.14	34.85
.70	23.07	10.69	** 24.62	35.45
.75	23.86	11.63	** 25.15	36.09
.80	24.66	12.57	** 25.73	36.75
.85	25.47	13.51	** 26.34	37.42
.90	26.28	14.45	** 26.98	38.11
.95	27.10	15.39	** 27.64	38.81
1.00	27.91	16.32	** 28.32	39.51
1.20	31.14	19.92	** 31.11	42.35
1.40	34.25	23.32	33.95	45.19
1.60	37.24	26.50	36.75	47.99
1.80	40.11	29.49	39.50	50.73
2.00	42.85	32.30	42.17	53.40
2.20	45.47	34.94	44.77	56.00
2.40	47.99	37.46	47.28	58.53
2.60	50.41	39.85	49.71	60.96
2.80	52.73	42.15	52.07	63.31
3.00	54.97	44.36	54.35	65.58
3.20	57.13	46.50	56.57	67.76
3.40	59.22	48.58	58.72	69.85
3.60	61.23	50.61	60.81	71.86
3.80	63.19	52.59	62.84	73.79
4.00	65.08	54.52	64.82	75.65
4.20	66.92	56.41	66.74	77.44
4.40	68.71	58.24	68.62	79.18
4.60	70.45	60.03	70.45	80.87
4.80	72.14	61.75	72.23	82.53
5.00	73.79	63.41	73.98	84.18
5.20	75.40	64.99	75.68	85.82

URESTER-4

30.0 IN. D.H.

2.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODFL		UPPER-P
.05	72.62	46.52	** 103.11	*	98.72
.10	47.51	21.82	** 68.02		73.20
.15	40.68	15.38	** 55.49		65.97
.20	39.35	14.44	** 50.19		64.27
.25	40.34	15.79	** 48.13		64.88
.30	42.45	18.25	** 47.77		66.64
.35	45.14	21.29	** 48.40		69.00
.40	48.16	24.63	** 49.64		71.69
.45	51.34	28.12	** 51.26		74.56
.50	54.60	31.68	** 53.13		77.52
.55	57.89	35.25	** 55.17		80.53
.60	61.17	38.80	** 57.32		83.54
.65	64.43	42.32	** 59.53		86.53
.70	67.64	45.77	** 61.78		89.51
.75	70.81	49.17	** 64.06		92.44
.80	73.92	52.50	** 66.35		95.34
.85	76.98	55.77	** 68.63		98.19
.90	79.99	58.97	** 70.90		101.01
.95	82.93	62.09	** 73.16		103.77
1.00	85.82	65.15	** 75.40		106.50
1.20	96.85	76.75	** 84.13		116.96
1.40	107.10	87.39	92.44		126.80
1.60	116.64	97.20	100.32		136.09
1.80	125.50	106.30	107.81		144.88
2.00	134.01	114.78	114.94		153.24
2.20	141.96	122.74	121.72	*	161.18
2.40	149.50	130.24	128.21	*	168.75
2.60	156.67	137.36	134.41	*	175.98
2.80	163.51	144.15	140.35	*	182.87
3.00	170.05	150.64	146.07	*	189.46
3.20	176.33	156.89	151.57	*	195.77
3.40	182.35	162.91	156.87	*	201.80
3.60	188.15	168.73	161.99	*	207.58
3.80	193.75	174.37	166.95	*	213.12
4.00	199.15	179.84	171.74	*	218.45
4.20	204.37	185.15	176.39	*	223.59
4.40	209.43	190.31	180.90	*	228.56
4.60	214.34	195.30	185.29	*	233.38
4.80	219.10	200.12	189.55	*	238.08
5.00	223.73	204.76	193.70	*	242.70
5.20	228.23	209.21	197.75	*	247.25



URESTER-4

30.0 IN. D.H.

4.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	IDCC	LOWER-P	MODFL	UPPER-P
.05	53.78	31.29 **	77.69 *	76.27
.10	31.58	9.44 **	49.65	53.72
.15	23.79	1.99 **	38.31	45.59
.20	20.60	- - **	32.52	42.07
.25	19.45	- - **	29.33	40.60
.30	19.38	- - **	27.56	40.22
.35	19.92	- - **	26.66	40.48
.40	20.84	.56 **	26.31	41.11
.45	21.99	1.99 **	26.34	42.00
.50	23.30	3.55 **	26.63	43.06
.55	24.71	5.20 **	27.11	44.22
.60	26.18	6.91 **	27.73	45.46
.65	27.69	8.64 **	28.45	46.74
.70	29.22	10.38 **	29.25	48.06
.75	30.76	12.12 **	30.11	49.41
.80	32.30	13.85 **	31.01	50.76
.85	33.84	15.56 **	31.94	52.12
.90	35.37	17.25 **	32.89	53.48
.95	36.88	18.92 **	33.86	54.84
1.00	38.38	20.57 **	34.84	56.19
1.20	44.21	26.88 **	38.81	61.54
1.40	49.75	32.76	42.76	66.73
1.60	54.99	38.23	46.62	71.75
1.80	59.96	43.33	50.36	76.59
2.00	64.68	48.11	53.97	81.25
2.20	69.18	52.61	57.45	85.74
2.40	73.46	56.87	60.81	90.06
2.60	77.56	60.93	64.05	94.20
2.80	81.49	64.81	67.18	98.18
3.00	85.27	68.54	70.21	102.00
3.20	88.90	72.15	73.14	105.65
3.40	92.40	75.64	75.98	109.16
3.60	95.78	79.04	78.74 *	112.52
3.80	99.04	82.35	81.41 *	115.74
4.00	102.20	85.57	84.00 *	118.84
4.20	105.27	88.71	86.53 *	121.83
4.40	108.24	91.76	88.99 *	124.72
4.60	111.13	94.72	91.38 *	127.54
4.80	113.94	97.58	93.72 *	130.30
5.00	116.67	100.33	96.00 *	133.02
5.20	119.34	102.94	98.22 *	135.73



URESTER-4

24.0 IN. D.H.

2.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	INCC	DECELERATION LOWER-P	(G) MODFL	UPPER-P
.05	65.10	46.67	** 92.43 *	83.53
.10	41.99	23.86	** 60.89 *	60.13
.15	34.99	17.13	** 49.16	52.84
.20	32.93	15.35	** 43.85	50.51
.25	33.00	15.68	** 41.45	50.32
.30	34.13	17.07	** 40.60	51.20
.35	35.85	19.03	** 40.67	52.68
.40	37.90	21.31	** 41.30	54.50
.45	40.14	23.77	** 42.31	56.52
.50	42.49	26.33	** 43.57	58.65
.55	44.90	28.94	** 45.00	60.85
.60	47.32	31.56	** 46.54	63.09
.65	49.75	34.17	** 48.16	65.33
.70	52.16	36.75	** 49.83	67.57
.75	54.56	39.31	** 51.53	69.80
.80	56.92	41.83	** 53.26	72.01
.85	59.25	44.30	** 54.99	74.20
.90	61.55	46.74	** 56.73	76.36
.95	63.81	49.13	** 58.46	78.49
1.00	66.03	51.47	** 60.19	80.59
1.20	74.55	60.39	** 66.07	88.71
1.40	82.52	68.64	73.48	96.40
1.60	89.98	76.28	79.71	103.67
1.80	96.99	83.40	85.64	110.58
2.00	103.61	90.06	91.30	117.15
2.20	109.87	96.33	96.72	123.41
2.40	115.82	102.26	101.00 *	129.39
2.60	121.49	107.89	106.86 *	135.10
2.80	126.91	113.27	111.64 *	140.55
3.00	132.10	118.42	116.23 *	145.77
3.20	137.08	123.38	120.65 *	150.77
3.40	141.86	128.17	124.92 *	155.56
3.60	146.47	132.79	129.05 *	160.16
3.80	150.93	137.28	133.04 *	164.57
4.00	155.23	141.63	136.92 *	168.82
4.20	159.39	145.85	140.67 *	172.93
4.40	163.42	149.94	144.32 *	176.90
4.60	167.34	153.91	147.87 *	180.76
4.80	171.14	157.74	151.32 *	184.53
5.00	174.83	161.43	154.68 *	188.23
5.20	178.43	164.97	157.96 *	191.89

URESTER-4

18.0 IN. D.H.

4.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODFL	UPPER-P
.05	41.67	32.11	** 60.24 *	51.24
.10	27.08	17.68	** 40.55 *	36.49
.15	21.22	11.97	** 31.99 *	30.46
.20	18.25	9.15	** 27.24	27.34
.25	16.62	7.68	** 24.31	25.57
.30	15.74	6.93	** 22.41	24.55
.35	15.30	6.64	** 21.14	23.97
.40	15.16	6.62	** 20.30	23.69
.45	15.20	6.79	** 19.76	23.61
.50	15.38	7.10	** 19.42	23.67
.55	15.66	7.49	** 19.25	23.83
.60	16.01	7.96	** 19.20	24.07
.65	16.42	8.47	** 19.24	24.36
.70	16.86	9.01	** 19.35	24.70
.75	17.33	9.58	** 19.52	25.07
.80	17.82	10.16	** 19.74	25.47
.85	18.32	10.75	** 20.00	25.89
.90	18.84	11.35	** 20.28	26.32
.95	19.36	11.96	** 20.59	26.77
1.00	19.89	12.56	** 20.92	27.23
1.20	22.04	14.96	** 22.37	29.11
1.40	24.16	17.27	** 23.94	31.04
1.60	26.22	19.47	25.56	32.97
1.80	28.22	21.56	27.18	34.89
2.00	30.15	23.54	28.79	36.77
2.20	32.02	25.43	30.37	38.60
2.40	33.81	27.22	31.92	40.39
2.60	35.54	28.95	33.43	42.13
2.80	37.21	30.60	34.91	43.81
3.00	38.82	32.20	36.35	45.44
3.20	40.38	33.76	37.75	47.01
3.40	41.89	35.27	39.12	48.52
3.60	43.36	36.74	40.46	49.98
3.80	44.78	38.18	41.76	51.39
4.00	46.16	39.58	43.04	52.75
4.20	47.51	40.95	44.28	54.06
4.40	48.81	42.29	45.49	55.34
4.60	50.09	43.60	46.68	56.58
4.80	51.33	44.86	47.84	57.80
5.00	52.54	46.08	48.98	59.00
5.20	53.72	47.24	50.09	60.20

URESTER-4

12.0 IN. D.H.

4.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G)	MODEL	UPPER-P
.05	35.14	25.14	**	49.23	* 45.14
.10	22.85	13.00	**	34.81	* 32.69
.15	17.61	7.92	**	28.00	* 27.30
.20	14.77	5.23	**	23.90	24.32
.25	13.07	3.67	**	21.14	22.48
.30	12.01	2.74	**	19.15	21.28
.35	11.34	2.20	**	17.66	20.47
.40	10.93	1.92	**	16.51	19.94
.45	10.69	1.80	**	15.61	19.58
.50	10.59	1.81	**	14.88	19.36
.55	10.57	1.91	**	14.30	19.24
.60	10.63	2.07	**	13.82	19.19
.65	10.74	2.29	**	13.43	19.20
.70	10.90	2.54	**	13.11	19.26
.75	11.09	2.81	**	12.85	19.36
.80	11.30	3.11	**	12.64	19.49
.85	11.53	3.43	**	12.47	19.64
.90	11.78	3.75	**	12.33	19.81
.95	12.05	4.08	**	12.22	20.01
1.00	12.32	4.42	**	12.14	20.21
1.20	13.48	5.80	**	12.00	21.15
1.40	14.68	7.17	**	12.08	22.19
1.60	15.90	8.49		12.28	23.30
1.80	17.10	9.76		12.57	24.43
2.00	18.27	10.97		12.91	25.58
2.20	19.42	12.13		13.29	26.72
2.40	20.54	13.24		13.70	27.85
2.60	21.63	14.31		14.12	* 28.95
2.80	22.69	15.35		14.56	* 30.03
3.00	23.72	16.36		14.99	* 31.07
3.20	24.72	17.35		15.44	* 32.08
3.40	25.69	18.32		15.88	* 33.05
3.60	26.63	19.28		16.32	* 33.99
3.80	27.55	20.22		16.76	* 34.89
4.00	28.45	21.14		17.20	* 35.76
4.20	29.33	22.05		17.64	* 36.60
4.40	30.18	22.94		18.07	* 37.42
4.60	31.02	23.81		18.49	* 38.22
4.80	31.83	24.65		18.91	* 39.02
5.00	32.63	25.45		19.33	* 39.81
5.20	33.41	26.21		19.74	* 40.61



URESTER-4

18.0 IN. D.H.

2.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECFLERATION LOWER-P	(G) MODFL	UPPER-P
.05	46.88	28.22	** 34.94	65.53
.10	30.40	12.05	** 20.82	48.74
.15	25.70	7.66	** 18.39	43.74
.20	24.58	6.84	** 19.28	42.32
.25	24.98	7.53	** 21.46	42.43
.30	26.13	8.95	** 24.21	43.30
.35	27.67	10.76	** 27.22	44.58
.40	29.44	12.78	** 30.32	46.09
.45	31.32	14.91	** 33.45	47.73
.50	33.27	17.10	** 36.55	49.44
.55	35.25	19.30	** 39.61	51.19
.60	37.22	21.49	** 42.61	52.95
.65	39.19	23.67	** 45.54	54.72
.70	41.14	25.81	** 48.41	56.47
.75	43.07	27.92	** 51.21	58.21
.80	44.96	30.00	** 53.94	59.93
.85	46.83	32.03	** 56.60	61.62
.90	48.66	34.02	** 59.20	63.30
.95	50.46	35.97	** 61.74	64.95
1.00	52.23	37.88	** 64.22	66.58
1.20	58.99	45.11	** 73.58	72.86
1.40	65.28	51.75	82.18	78.80
1.60	71.15	57.87	90.13	84.44
1.80	76.66	63.53	97.53	89.80
2.00	81.86	68.80	104.46	94.91
2.20	86.76	73.74	110.98	99.79
2.40	91.42	78.39	117.14	104.45
2.60	95.85	82.79	122.97	108.91
2.80	100.08	86.99	128.53	113.18
3.00	104.13	91.01	133.83	117.26
3.20	108.01	94.87	138.00	121.16
3.40	111.74	98.59	143.77	124.90
3.60	115.34	102.20	148.44	128.48
3.80	118.80	105.69	152.94	131.91
4.00	122.15	109.09	157.28	135.21
4.20	125.39	112.38	161.47	138.40
4.40	128.52	115.58	165.53	141.47
4.60	131.57	118.67	169.46	144.46
4.80	134.52	121.66	173.27	147.38
5.00	137.39	124.53	176.96	150.26
5.20	140.18	127.26	180.56	153.10



URESTER-4

30.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION (G)		
		LOWER-P	MODFL	UPPER-P
.05	106.02	66.84	** 126.18	145.20
.10	81.41	43.07	** 100.62	119.75
.15	80.50	42.98	** 96.11	118.02
.20	85.88	49.15	** 97.59	122.62
.25	93.51	57.53	** 101.41	129.49
.30	101.98	66.73	** 106.26	137.23
.35	110.71	76.15	** 111.58	145.26
.40	119.43	85.54	** 117.09	153.32
.45	128.02	94.77	** 122.64	161.28
.50	136.42	103.77	** 128.16	169.07
.55	144.60	112.52	** 133.60	176.67
.60	152.54	121.01	** 138.94	184.07
.65	160.25	129.23	** 144.17	191.27
.70	167.73	137.20	** 149.27	198.27
.75	175.00	144.92	** 154.26	205.08
.80	182.06	152.41	** 159.12	211.71
.85	188.92	159.66	** 163.87	218.18
.90	195.50	166.71	** 168.50	224.48
.95	202.00	173.54	** 173.02	230.63
1.00	208.41	180.18	** 177.44	236.64
1.20	232.18	204.95	194.15	259.40
1.40	253.84	227.26	209.49	280.42
1.60	273.77	247.54	223.68	299.99
1.80	292.24	266.15	236.89	318.33
2.00	309.48	283.37	249.25	335.58
2.20	325.65	299.45	260.89	351.85
2.40	340.89	314.56	271.88	367.23
2.60	355.32	328.86	282.31	381.78
2.80	369.02	342.47	292.23	395.58
3.00	382.08	355.49	301.70	408.67
3.20	394.55	367.99	310.76	421.12
3.40	406.50	380.02	319.45	432.98
3.60	417.97	391.62	327.80	444.32
3.80	429.00	402.80	335.84	455.19
4.00	439.62	413.57	343.59	465.68
4.20	449.88	423.91	351.08	475.85
4.40	459.70	433.79	358.33	485.80
4.60	469.30	443.17	365.34	495.61
4.80	478.60	451.99	372.15	505.38
5.00	487.71	460.21	378.76	515.21
5.20	496.47	467.78	385.18	525.17

URESTER-4

12.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G)	MODEL	UPPER-P
.05	39.52	18.06	**	36.31	60.97
.10	24.57	3.39	**	20.54	45.75
.15	19.45	- -	**	15.10	40.36
.20	17.44	- -	**	12.94	38.09
.25	16.80	- -	**	12.24	37.21
.30	16.88	- -	**	12.29	37.05
.35	17.37	- -	**	12.77	37.31
.40	18.11	- -	**	13.52	37.83
.45	19.00	- -	**	14.43	38.51
.50	19.99	.68	**	15.45	39.29
.55	21.04	1.92	**	16.53	40.15
.60	22.12	3.20	**	17.65	41.05
.65	23.23	4.48	**	18.79	41.98
.70	24.35	5.77	**	19.95	42.93
.75	25.47	7.05	**	21.11	43.89
.80	26.59	8.32	**	22.27	44.86
.85	27.70	9.58	**	23.43	45.83
.90	28.81	10.82	**	24.57	46.80
.95	29.90	12.04	**	25.71	47.76
1.00	30.98	13.24	**	26.83	48.72
1.20	35.17	17.84	**	31.18	52.50
1.40	39.13	22.11		35.30	56.16
1.60	42.88	26.07		39.20	59.69
1.80	46.42	29.76		42.88	63.09
2.00	49.79	33.20		46.38	66.37
2.20	52.98	36.43		49.71	69.54
2.40	56.03	39.48		52.88	72.58
2.60	58.94	42.37		55.92	75.51
2.80	61.73	45.13		58.82	78.33
3.00	64.41	47.78		61.61	81.03
3.20	66.98	50.33		64.29	83.63
3.40	69.46	52.79		66.88	86.12
3.60	71.85	55.19		69.37	88.52
3.80	74.16	57.51		71.78	90.81
4.00	76.40	59.78		74.11	93.02
4.20	78.57	61.99		76.37	95.14
4.40	80.67	64.15		78.56	97.19
4.60	82.71	66.25		80.69	99.17
4.80	84.70	68.30		82.76	101.09
5.00	86.63	70.28		84.78	102.98
5.20	88.51	72.19		86.74	104.83

URESTER-4

18.0 IN. D.H.

4.0 IN. THICK

-20.0 TEMPERATURE

## STATIC STRESS

PSI	IDCC	DECELERATION LOWER-P	(G) MODEL	UPPER-P
.05	108.38	84.29	96.84	132.47
.10	76.55	52.70	70.29	100.39
.15	60.99	37.38	57.28	84.60
.20	51.33	27.95	49.18	74.71
.25	44.62	21.46	43.54	67.78
.30	39.65	16.70	39.36	62.60
.35	35.80	13.06	36.11	58.55
.40	32.73	10.19	33.52	55.28
.45	30.23	7.88	31.40	52.59
.50	28.15	5.98	29.64	50.33
.55	26.41	4.41	28.15	48.40
.60	24.92	3.09	26.89	46.75
.65	23.65	1.98	25.80	45.32
.70	22.55	1.03	24.85	44.06
.75	21.59	.22	24.03	42.96
.80	20.75	- -	23.31	41.98
.85	20.02	- -	22.68	41.11
.90	19.37	- -	22.12	40.34
.95	18.81	- -	21.62	39.65
1.00	18.30	- -	** 21.18	39.03
1.20	16.81	- -	** 19.86	37.14
1.40	15.91	- -	** 19.04	35.93
1.60	15.39	- -	** 18.55	35.18
1.80	15.13	- -	** 18.28	34.76
2.00	15.07	- -	** 18.18	34.58
2.20	15.14	- -	** 18.19	34.58
2.40	15.32	- -	** 18.29	34.72
2.60	15.57	- -	** 18.46	34.96
2.80	15.89	- -	** 18.68	35.28
3.00	16.25	- -	** 18.94	35.65
3.20	16.64	- -	19.24	36.06
3.40	17.07	- -	19.56	36.49
3.60	17.51	- -	19.90	36.94
3.80	17.98	- -	20.25	37.40
4.00	18.45	- -	20.62	37.87
4.20	18.94	- -	21.00	38.33
4.40	19.44	.08	21.38	38.79
4.60	19.94	.63	21.77	39.24
4.80	20.44	1.19	22.17	39.70
5.00	20.95	1.75	22.57	40.15
5.20	21.46	2.30	22.97	40.62



URESTER-4

18.0 IN. D.H.

1.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

## DECELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	71.75	20.58	** 62.63	122.92
.10	56.58	6.23	** 47.19	106.93
.15	54.61	5.05	** 46.98	104.17
.20	56.30	7.50	** 50.79	105.10
.25	59.38	11.31	** 56.01	107.44
.30	63.04	15.68	** 61.73	110.40
.35	66.93	20.25	** 67.60	113.62
.40	70.91	24.87	** 73.45	116.94
.45	74.87	29.46	** 79.19	120.28
.50	78.78	33.96	** 84.80	123.59
.55	82.61	38.36	** 90.24	126.86
.60	86.35	42.64	** 95.53	130.07
.65	90.01	46.81	** 100.66	133.20
.70	93.56	50.85	** 105.64	136.28
.75	97.03	54.78	** 110.47	139.28
.80	100.40	58.59	** 115.15	142.22
.85	103.69	62.28	** 119.71	145.10
.90	106.90	65.87	** 124.13	147.93
.95	110.02	69.35	** 128.44	150.69
1.00	113.07	72.74	** 132.63	153.40
1.20	124.56	85.34	148.38	163.78
1.40	135.08	96.65	162.72	173.51
1.60	144.79	106.88	175.91	182.71
1.80	153.82	116.19	188.13	191.44
2.00	162.25	124.75	199.52	199.76
2.20	170.18	132.68	210.21	* 207.68
2.40	177.66	140.09	220.28	* 215.23
2.60	184.75	147.07	229.81	* 222.43
2.80	191.40	153.70	238.86	* 229.29
3.00	197.92	160.04	247.48	* 235.81
3.20	204.07	166.13	255.71	* 242.01
3.40	209.96	172.02	263.60	* 247.91
3.60	215.62	177.73	271.17	* 253.52
3.80	221.07	183.28	278.45	* 258.86
4.00	226.32	188.68	285.46	* 263.97
4.20	231.39	193.92	292.22	* 268.87
4.40	236.30	199.00	298.76	* 273.59
4.60	241.05	203.91	305.09	* 278.19
4.80	245.65	208.61	311.23	* 282.69
5.00	250.12	213.07	317.18	* 287.16
5.20	254.46	217.26	322.96	* 291.66



URESTER-4

24.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI	INCC	DECELFRATION LOWER-P	(G) MODFL	UPPER-P
.05	104.37	69.15	** 113.56	139.59
.10	78.69	44.05	** 87.43	113.34
.15	73.24	39.15	** 81.08	107.34
.20	73.66	40.10	** 80.58	107.22
.25	76.43	43.39	** 82.47	109.48
.30	80.29	47.73	** 85.50	112.84
.35	84.66	52.58	** 89.10	116.74
.40	89.27	57.64	** 92.99	120.90
.45	93.98	62.78	** 97.02	125.17
.50	98.69	67.91	** 101.09	129.47
.55	103.36	72.98	** 105.16	133.75
.60	107.97	77.97	** 109.19	137.98
.65	112.50	82.85	** 113.17	142.15
.70	116.93	87.62	** 117.08	146.25
.75	121.28	92.29	** 120.92	150.27
.80	125.52	96.84	** 124.68	154.21
.85	129.68	101.27	** 128.37	158.08
.90	133.74	105.60	** 131.99	161.88
.95	137.71	109.82	** 135.52	165.60
1.00	141.50	113.93	** 138.99	169.25
1.20	156.30	129.41	152.16	183.19
1.40	169.85	143.51	164.33	196.20
1.60	182.42	156.43	175.65	208.41
1.80	194.14	168.34	186.22	219.94
2.00	205.13	179.41	196.16	230.85
2.20	215.48	189.76	205.52	241.20
2.40	225.27	199.50	214.39	251.04
2.60	234.57	208.72	222.82	260.41
2.80	243.42	217.50	230.86	269.33
3.00	251.87	225.89	238.53	277.85
3.20	259.96	233.95	245.88	285.97
3.40	267.72	241.71	252.94	293.73
3.60	275.19	249.21	259.74	301.16
3.80	282.38	256.47	266.28	308.28
4.00	289.31	263.50	272.60	315.12
4.20	296.02	270.31	278.70	321.72
4.40	302.50	276.90	284.61	328.10
4.60	308.79	283.27	290.34	334.31
4.80	314.88	289.39	295.90	340.38
5.00	320.81	295.24	301.31	346.37
5.20	326.56	300.81	306.56	352.32

URESTER-4

24.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	50.35	15.75	**	52.62	84.95
.10	34.64	.64	**	36.03	68.64
.15	32.40	-	**	33.24	65.81
.20	33.91	1.06	**	34.36	66.77
.25	36.86	4.55	**	37.00	69.18
.30	40.43	8.64	**	40.31	72.22
.35	44.25	12.97	**	43.91	75.54
.40	48.16	17.36	**	47.62	78.96
.45	52.07	21.74	**	51.36	82.40
.50	55.93	26.05	**	55.07	85.82
.55	59.73	30.27	**	58.72	89.19
.60	63.44	34.39	**	62.30	92.49
.65	67.06	38.40	**	65.80	95.72
.70	70.59	42.31	**	69.22	98.88
.75	74.03	46.10	**	72.55	101.97
.80	77.39	49.79	**	75.81	104.98
.85	80.66	53.38	**	78.98	107.94
.90	83.84	56.86	**	82.08	110.82
.95	86.95	60.25	**	85.10	113.65
1.00	89.98	63.55	**	88.06	116.42
1.20	101.43	75.89		99.21	126.97
1.40	111.91	87.03		109.45	136.80
1.60	121.59	97.15		118.92	146.03
1.80	130.59	106.43		127.73	154.76
2.00	139.01	114.99		135.97	163.03
2.20	146.92	122.95		143.73	170.90
2.40	154.40	130.40		151.05	178.39
2.60	161.48	137.42		158.00	185.53
2.80	168.21	144.09		164.61	192.33
3.00	174.63	150.45		170.92	198.82
3.20	180.78	156.56		176.95	205.00
3.40	186.67	162.44		182.74	210.89
3.60	192.32	168.12		188.30	216.53
3.80	197.77	173.62		193.65	221.91
4.00	203.02	178.96		198.81	227.08
4.20	208.09	184.13		203.80	232.05
4.40	212.99	189.13		208.62	236.85
4.60	217.74	193.97		213.29	241.51
4.80	222.34	198.61		217.82	246.08
5.00	226.81	203.04		222.22	250.58
5.20	231.15	207.23		226.49	255.08

URESTER-4

30.0 IN. D.H.

1.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

## DECCELERATION (G)

PSI	IDCC	LOWER-P	MODEL	UPPER-P
.05	98.07	76.02	** 108.45	120.11
.10	85.57	64.14	** 79.03	107.00
.15	89.16	68.33	** 77.45	110.00
.20	96.60	76.34	** 83.32	116.86
.25	105.16	85.45	** 91.87	124.86
.30	113.96	94.79	** 101.45	133.13
.35	122.67	104.02	** 111.38	141.33
.40	131.16	113.00	** 121.32	149.33
.45	139.38	121.68	** 131.12	157.07
.50	147.30	130.06	** 140.72	164.54
.55	154.93	138.12	** 150.07	171.74
.60	162.29	145.89	** 159.17	178.70
.65	169.39	153.37	** 168.00	185.41
.70	176.24	160.59	** 176.59	191.89
.75	182.86	167.55	** 184.92	198.17
.80	189.26	174.28	** 193.02	204.25
.85	195.46	180.78	** 200.89	210.15
.90	201.47	187.07	** 208.56	215.88
.95	207.31	193.16	** 216.01	221.45
1.00	212.97	199.06	** 223.28	226.88
1.20	234.16	221.00	250.59	* 247.31
1.40	253.34	240.66	275.50	* 266.01
1.60	270.89	258.46	298.43	* 283.32
1.80	287.10	274.75	319.69	* 299.45
2.00	302.18	289.80	339.54	* 314.56
2.20	316.28	303.83	358.16	* 328.74
2.40	329.55	317.00	375.72	* 342.10
2.60	342.08	329.46	392.34	* 354.70
2.80	353.97	341.31	408.13	* 366.62
3.00	365.27	352.62	423.17	* 377.92
3.20	376.06	363.45	437.55	* 388.66
3.40	386.37	373.84	451.32	* 398.90
3.60	396.26	383.80	464.54	* 408.73
3.80	405.77	393.33	477.26	* 418.20
4.00	414.92	402.42	489.51	* 427.42
4.20	423.74	411.03	501.34	* 436.45
4.40	432.26	419.12	512.77	* 445.40
4.60	440.50	426.67	523.83	* 454.33
4.80	448.48	433.65	534.56	* 463.31
5.00	456.22	440.06	544.96	* 472.38
5.20	463.73	445.90	555.07	* 481.56

SECTION V  
POLYETHER URETHANE  
(3 Lb./Ft.<sup>3</sup>)



### URETHER 3 MODEL VALIDATION

MICOM Report No. RL-CR-75-1 [2] developed individual dynamic cushioning curves, 50 out of 60 being statistically significant at an alpha level of .05. This cushioning material is not considered adequate below  $-20^{\circ}\text{F}$ . Consequently, analysis has not been conducted at  $-65^{\circ}\text{F}$ .

The model validation for Urether 3 followed the same procedure developed for the Minicel material. Table 5 presents the coefficients and variables for the Urether 3 model.

Sixty different combinations of drop height, temperature, and cushion thickness were evaluated. All of the 60 combinations were acceptable based upon the established validation criteria. Selected samples of these combinations are shown on pages 108 through 113. In addition, 49 of the 60 combinations were within the prediction limits over the entire static stress range considered.

TABLE 5  
URETHER 3 MODEL

Variable	Coefficients	$\theta$	$\theta^2$	$\theta^3$	$h^{1/2}$	$T^{-1/2}$	$T^{-3/2}$	$(\ln \sigma_s)$	$(\ln \sigma_s)^2$
0	15.456637								
1	0.0	X				X			
2	0.0	X				X		X	
3	13.26693	X				X			X
4	-3.6616161	X			X		X		
5	0.0	X			X		X	X	
6	0.0	X			X		X		X
7	63.974659	X			X	X			
8	-9.0635167	X			X	X		X	
9	-4.6111397	X			X	X			X
10	0.0		X			X			
11	3.474952		X			X		X	
12	-5.9426191		X			X			X
13	0.40180169		X		X		X		
14	1.8227191		X		X		X	X	
15	0.0		X		X		X		X
16	-18.556663		X		X	X			
17	0.0		X		X	X		X	
18	2.2098166		X		X	X			X
19	-0.71661025			X		X			
20	0.0			X		X		X	
21	0.49953221			X		X			X
22	0.0			X	X		X		
23	-0.15167925			X	X		X	X	
24	-0.015276062			X	X		X		X
25	1.6300623			X	X	X			
26	0.0			X	X	X		X	
27	-0.19795351			X	X	X			X
28	21.394161	X					X		
29	-18.657659	X					X	X	
30	0.0	X					X		X
31	0.0		X				X		
32	0.0		X				X	X	
33	0.40841276		X				X		X
34	0.0			X			X		
35	0.0			X			X	X	
36	0.0			X			X		X

URETHER-3

12.0 IN. D.H.

2.0 IN. THICK

70.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	28.09	10.84	**	28.24	45.33
.10	18.23	1.27	**	15.22	35.20
.15	15.31	- -	**	11.03	32.01
.20	14.50	- -	**	9.59	30.95
.25	14.61	- -	**	9.34	30.81
.30	15.16	- -	**	9.71	31.12
.35	15.96	.22	**	10.42	31.69
.40	16.89	1.38	**	11.33	32.41
.45	17.91	2.60	**	12.36	33.22
.50	18.97	3.85	**	13.46	34.08
.55	20.04	5.12	**	14.60	34.96
.60	21.13	6.39	**	15.77	35.87
.65	22.21	7.64	**	16.94	36.78
.70	23.29	8.88	**	18.12	37.69
.75	24.35	10.10	**	19.29	38.61
.80	25.40	11.29	**	20.45	39.51
.85	26.44	12.47	**	21.60	40.41
.90	27.46	13.61	**	22.73	41.30
.95	28.46	14.73	**	23.85	42.19
1.00	29.45	15.83	**	24.95	43.06
1.20	33.22	19.97	**	29.20	46.46
1.40	36.74	23.75		33.19	49.72
1.60	40.03	27.22		36.95	52.85
1.80	43.13	30.40		40.48	55.85
2.00	46.05	33.36		43.83	58.73
2.20	48.81	36.12		47.00	61.49
2.40	51.43	38.72		50.02	64.14
2.60	53.93	41.18		52.90	66.67
2.80	56.31	43.52		55.65	69.10
3.00	58.59	45.78		58.29	71.41
3.20	60.78	47.95		60.82	73.61
3.40	62.89	50.06		63.26	75.72
3.60	64.92	52.11		65.61	77.73
3.80	66.87	54.10		67.88	79.65
4.00	68.77	56.04		70.08	81.49
4.20	70.60	57.94		72.20	83.26
4.40	72.37	59.77		74.27	84.96
4.60	74.09	61.55		76.27	86.63
4.80	75.76	63.25		78.21	88.27
5.00	77.38	64.87		80.10	89.89
5.20	78.96	66.40		81.94	91.53

URETHAN-3      18.0 IN. D.H.      4.0 IN. THICK      -20.0 TEMPERATURE

STATIC STRESS		DECELERATION		(G)	
PSI	INCC	LOWER-P		MODEL	UPPER-P
.05	50.72	36.72	**	48.21	64.72
.10	32.28	18.49	**	31.38	46.06
.15	24.36	10.79	**	24.41	37.93
.20	20.02	6.65	**	20.75	33.39
.25	17.39	4.22	**	18.65	30.57
.30	15.72	2.74	**	17.41	28.71
.35	14.64	1.84	**	16.70	27.44
.40	13.95	1.32	**	16.33	26.58
.45	13.54	1.07	**	16.19	26.00
.50	13.31	1.01	**	16.22	25.62
.55	13.24	1.08	**	16.37	25.39
.60	13.27	1.25	**	16.62	25.28
.65	13.38	1.51	**	16.92	25.26
.70	13.56	1.81	**	17.28	25.31
.75	13.80	2.17	**	17.68	25.42
.80	14.07	2.55	**	18.11	25.58
.85	14.37	2.97	**	18.56	25.78
.90	14.70	3.40	**	19.03	26.01
.95	15.05	3.84	**	19.51	26.26
1.00	15.42	4.30	**	20.00	26.54
1.20	17.00	6.17	**	22.03	27.83
1.40	18.67	8.05	**	24.07	29.30
1.60	20.37	9.88		26.10	30.86
1.80	22.06	11.64		28.07	32.47
2.00	23.71	13.32		29.09	34.10
2.20	25.34	14.95		31.85	35.73
2.40	26.92	16.51		33.64	37.34
2.60	28.47	18.03		35.38	38.91
2.80	29.97	19.50		37.07	40.44
3.00	31.43	20.94		38.70	41.93
3.20	32.86	22.35		40.29	43.36
3.40	34.24	23.74		41.82	44.75
3.60	35.59	25.11		43.32	46.08
3.80	36.91	26.46		44.77	47.36
4.00	38.19	27.78		46.18	48.60
4.20	39.45	29.09		47.55	49.80
4.40	40.67	30.37		48.89	50.97
4.60	41.86	31.61		50.19	52.11
4.80	43.03	32.82		51.47	53.24
5.00	44.17	33.97		52.71	54.37
5.20	45.29	35.06		53.92	55.52



URETHAN-3

18.0 IN. D.H.

1.0 IN. THICK

110.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECELERATION (G)

LOWER-P

MODFL

UPPER-P

.05	42.73	.45	**	38.19	85.02
.10	31.19	- -	**	31.19	72.81
.15	32.96	- -	**	35.18	73.94
.20	38.03	- -	**	41.63	78.39
.25	44.15	4.39	**	48.69	83.90
.30	50.56	11.38	**	55.81	89.74
.35	56.97	18.34	**	62.76	95.60
.40	63.25	25.15	**	69.49	101.36
.45	69.37	31.77	**	75.95	106.96
.50	75.29	38.17	**	82.16	112.40
.55	81.00	44.35	**	88.13	117.66
.60	86.53	50.31	**	93.86	122.74
.65	91.87	56.07	**	99.38	127.66
.70	97.03	61.62	**	104.69	132.43
.75	102.02	66.99	**	109.82	137.05
.80	106.86	72.18	**	114.77	141.54
.85	111.54	77.19	**	119.56	145.89
.90	116.09	82.05	**	124.20	150.13
.95	120.51	86.76	**	128.70	154.26
1.00	124.80	91.33	**	133.06	158.28
1.20	140.88	108.30		149.34	173.46
1.40	155.47	123.53		164.05	187.41
1.60	168.84	137.31		177.48	200.37
1.80	181.20	149.90		189.87	212.49
2.00	192.70	161.50		201.38	223.90
2.20	203.47	172.27		212.14	234.68
2.40	213.61	182.35		222.25	244.87
2.60	223.20	191.85		231.79	254.54
2.80	232.29	200.85		240.83	263.72
3.00	240.94	209.43		249.43	272.45
3.20	249.20	217.65		257.62	280.74
3.40	257.10	225.55		265.46	288.65
3.60	264.68	233.18		272.97	296.18
3.80	271.96	240.55		280.19	303.38
4.00	278.98	247.69		287.13	310.27
4.20	285.74	254.60		293.82	316.89
4.40	292.28	261.29		300.29	323.27
4.60	298.60	267.74		306.53	329.46
4.80	304.73	273.95		312.58	335.50
5.00	310.67	279.89		318.44	341.44
5.20	316.43	285.54		324.14	347.33

URETHAN-3

24.0 IN. D.H.

1.0 IN. THICK

20.0 TEMPERATURE

## STATIC STRESS

PSI

IDCC

## DECCELERATION

(G)

LOWER-P

MODEL

UPPER-P

.05	51.94	8.07	**	67.19	95.80
.10	46.00	2.88	**	53.44	89.13
.15	50.64	8.24	**	54.46	93.05
.20	57.56	15.85	**	59.25	99.28
.25	65.01	23.96	**	65.29	106.05
.30	72.43	32.03	**	71.73	112.83
.35	79.66	39.88	**	78.23	119.43
.40	86.61	47.43	**	84.65	125.79
.45	93.29	54.68	**	90.91	131.89
.50	99.69	61.63	**	96.99	137.74
.55	105.82	68.30	**	102.88	143.35
.60	111.72	74.69	**	108.58	148.74
.65	117.38	80.84	**	114.09	153.92
.70	122.83	86.75	**	119.43	158.92
.75	128.08	92.43	**	124.60	163.73
.80	133.16	97.92	**	129.62	168.39
.85	138.06	103.21	**	134.48	172.91
.90	142.80	108.32	**	139.20	177.28
.95	147.40	113.27	**	143.79	181.54
1.00	151.86	118.06	**	148.26	185.67
1.20	168.49	135.79		164.99	201.20
1.40	183.50	151.60		180.20	215.40
1.60	197.19	165.84		194.16	228.54
1.80	209.81	178.81		207.07	240.82
2.00	221.53	190.70		219.10	252.36
2.20	232.48	201.71		230.37	263.25
2.40	242.76	211.97		240.99	273.55
2.60	252.46	221.61		251.02	283.32
2.80	261.65	230.72		260.55	292.59
3.00	270.39	239.38		269.62	301.40
3.20	278.72	247.67		278.28	309.78
3.40	286.68	255.62		286.56	317.75
3.60	294.31	263.28		294.51	325.34
3.80	301.64	270.69		302.16	332.59
4.00	308.69	277.85		309.52	339.53
4.20	315.48	284.79		316.62	346.18
4.40	322.04	291.49		323.48	352.59
4.60	328.38	297.97		330.12	358.80
4.80	334.52	304.19		336.55	364.85
5.00	340.47	310.15		342.79	370.79
5.20	346.24	315.80		348.85	376.69

URETHER-3

24.0 IN. D.H.

2.0 IN. THICK

160.0 TEMPERATURE

## STATIC STRESS

PSI	INCC	DECELERATION (G)		UPPER-P
		LOWER-P	MODEL	
.05	31.50	- -	** 33.22	84.09
.10	15.42	- -	** 19.06	67.18
.15	13.70	- -	** 17.88	64.67
.20	15.93	- -	** 20.22	66.14
.25	19.63	- -	** 23.85	69.10
.30	23.93	- -	** 27.99	72.69
.35	28.46	- -	** 32.33	76.54
.40	33.05	- -	** 36.69	80.48
.45	37.61	- -	** 41.01	84.41
.50	42.09	- -	** 45.25	88.30
.55	46.48	.83	** 49.40	92.12
.60	50.76	5.65	** 53.43	95.86
.65	54.92	10.33	** 57.35	99.52
.70	58.98	14.87	** 61.17	103.09
.75	62.92	19.28	** 64.88	106.57
.80	66.77	23.55	** 68.48	109.98
.85	70.50	27.70	** 71.99	113.31
.90	74.15	31.72	** 75.41	116.57
.95	77.69	35.63	** 78.73	119.75
1.00	81.15	39.43	** 81.98	122.88
1.20	94.19	53.57	94.18	134.80
1.40	106.10	66.28	105.33	145.92
1.60	117.08	77.78	115.59	156.39
1.80	127.29	88.27	125.12	166.30
2.00	136.82	97.92	134.02	175.71
2.20	145.77	106.88	142.37	184.66
2.40	154.22	115.26	150.25	193.17
2.60	162.22	123.15	157.71	201.28
2.80	169.82	130.65	164.80	209.00
3.00	177.07	137.81	171.56	216.34
3.20	184.01	144.69	178.02	223.32
3.40	190.65	151.33	184.21	229.97
3.60	197.03	157.76	190.15	236.30
3.80	203.17	164.00	195.87	242.33
4.00	209.08	170.07	201.38	248.09
4.20	214.70	175.97	206.70	253.62
4.40	220.32	181.68	211.84	258.95
4.60	225.66	187.21	216.81	264.12
4.80	230.85	192.51	221.64	269.18
5.00	235.88	197.57	226.32	274.19
5.20	240.77	202.34	230.87	279.19



URETHER-3      30.0 IN. D.H.      1.0 IN. THICK      160.0 TEMPRATURE

STATIC STRESS		DECELFRATION		(G)	
PSI	IDCC	LOWER-P	MODEL	UPPER-P	
.05	57.11	- -	** 59.22	119.29	
.10	55.40	- -	** 55.31	115.89	
.15	65.89	7.02	** 64.31	124.76	
.20	78.47	21.17	** 75.74	135.77	
.25	91.17	35.38	** 87.51	146.97	
.30	103.46	49.11	** 98.99	157.80	
.35	115.18	62.22	** 110.01	168.14	
.40	126.32	74.69	** 120.54	177.96	
.45	136.92	86.55	** 130.57	187.29	
.50	147.00	97.83	** 140.14	196.17	
.55	156.62	108.58	** 149.28	204.65	
.60	165.80	118.84	** 158.03	212.77	
.65	174.60	128.65	** 166.41	220.55	
.70	183.04	138.03	** 174.47	228.04	
.75	191.15	147.03	** 182.22	235.27	
.80	198.96	155.66	** 189.68	242.25	
.85	206.49	163.95	** 196.89	249.02	
.90	213.76	171.93	** 203.85	255.60	
.95	220.80	179.60	** 210.59	261.99	
1.00	227.61	187.00	** 217.12	268.22	
1.20	252.93	214.11	241.42	291.75	
1.40	275.68	237.87	263.28	313.48	
1.60	296.37	258.99	283.18	333.75	
1.80	315.38	278.01	301.49	352.75	
2.00	333.00	295.40	318.46	370.60	
2.20	349.43	311.50	334.30	387.36	
2.40	364.84	326.59	349.16	403.09	
2.60	379.36	340.88	363.18	417.83	
2.80	393.09	354.53	376.44	431.66	
3.00	406.14	367.64	389.03	444.64	
3.20	418.56	380.27	401.03	456.85	
3.40	430.43	392.46	412.50	468.39	
3.60	441.79	404.17	423.48	479.40	
3.80	452.69	415.37	434.02	490.01	
4.00	463.17	425.94	444.16	500.40	
4.20	473.27	435.76	453.92	510.77	
4.40	483.01	444.68	463.34	521.33	
4.60	492.42	452.54	472.45	532.29	
4.80	501.52	459.23	481.26	543.82	
5.00	510.35	464.66	489.80	556.03	
5.20	518.90	468.83	498.09	568.98	



## CONCLUSIONS

This research has validated the five mathematical cushioning models developed as part of the overall MICOM cushioning material research program. In particular, the application of the results of MICOM Report No. RL-CR-76-3 [5] permitted a cost effective model validation procedure to be developed.

Thirty-six combinations of drop height, temperature, and static stress were evaluated for the Minicel model. Only one was outside the prediction limits.

Seventy-two combinations were evaluated for the Ethafoam 2 model. Fourteen of these combinations contained model values outside of the prediction limits. However, only six of these combinations are of any concern to the validation procedure.

Seventy-two combinations were evaluated for the Ethafoam 4 model. Only three of these combinations could not achieve the criteria established for model validation, with two cases being much more important than the other one.

Sixty combinations were evaluated for the Urester 4 model. Nine of these combinations contained one or more values outside of the prediction limits. Only two of these nine combinations are of any concern.

Sixty combinations were evaluated for the Urether 3 model, with all sixty being acceptable.

Thus, five different cushioning material models were validated utilizing 300 different combinations of material, drop height, temperature, and cushion thickness. Only 27 of these combinations were outside of the established criteria for model validation. However, even more meaningful is the evidence that only 11 of the 27 combinations are of any concern in the validation procedure. The combinations of

concern are well within the level of significance established for the overall cushioning material research effort.

Based on the preceding evidence, it is concluded that the five mathematical models are valid at a statistical significance level of .05.

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6. McDaniel, Don M., "Modeling The Impact Response of Bulk Cushioning Materials," Technical Report RD-75-16, U. S. Army Missile Command, Redstone Arsenal, Alabama, 1975.
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APPENDIX  
COMPUTER PROGRAM LISTING



This program calculates the G-level values for the individual Dynamic Cushioning Curves (IDCC), Lower Prediction Limits (LOWER-P), Generalized Model (MODEL), and the Upper Prediction Limits (UPPER-P), for a given static stress, drop height, cushioning material thickness, and temperature. Primary input data are the specific material model coefficients, and the results recorded on magnetic tape, from the curvilinear regression program as described in [1,2,3,4,5]. The main driver allows the user to select one of two options: 1) All data cases for the results on magnetic tape, or 2) an individual data case.

```

C *****
C VALADATION OF CUSHION MATERIAL MODELS
C *****

      DIMENSION X(500),Y(500),YM(500),YL(500),YU(500),YPL(500),
* YPU(500),B(5,4),IA(2),ID(2),V(50),COEFF(50),MD(45,10)

C
      REWIND 12
      RANGE=1.0
      NR=5

C
      READ AND PRINT CUSHION MATERIAL TERMS AND COEFFICIENTS.
C
      DO 5 I=1,45
      READ(5,892) (MD(I,J),J=1,10)
      CONTINUE
      READ(5,891) IS,ID(1),ID(2)
      READ(NR,890) NV
      READ(NR,900) CO,(COEFF(I),I=1,NV)
      WRITE(6,893) ID(1),ID(2)
      WRITE(6,894) CO
      DO 7 I=1,NV
      WRITE(6,895) I,COEFF(I),(MD(I,J),J=1,10)
      CONTINUE
C
      SPECIAL CASE IS=0,ALL DATA CASES IS=1
C
10    IF (IS .EQ. 1) GO TO 30
C
      REWIND 12
      READ(5,889,END=800) THICK,DROP,TEMP
30    CONTINUE
      READ(12)NPIS
      IF (NPIS.EQ.99999) GO TO 800
      NPIS=NPIS+1
      READ(12)DHT,TEM,THICK,(IA(II),II=1,2),(B(KK,JJ),
* KK=1,5),JJ=1,4),(X(LL),LL=2,NPIS),(Y(LL),LL=2,NPIS)
      IF (IS .EQ. 1) GO TO 32
      IF (THICK.NE.THICK) GO TO 30
      IF (TEMP.NE.TEM) GO TO 30
      IF (DHT.NE.DROP) GO TO 30
32    WRITE(6,899) ID(1),ID(2),DHT,THICK,TEM
      X(1)=NPIS
      I(1)=NPIS

C
      CALCULATE CONFIDENCE LIMITS
C
      CALL CONFID(X,I,NPIS,YL,YU,B)
      DELTA=0.05
      X(2)=0.05
      I=2
      N=2

```

```

55  CONTINUE
    IF (X(I).GT. 5.2) GOTO 50
    IF (X(I) .GE. .95) DELTA=0.2
C
C  SECOND ORDER POLYNOMIAL
C
    Y(1)=B(1,N)+B(2,N)*(ALOG(X(I)*100.))
    I=I+1
    X(1)=X(I-1)+DELTA
    GOTO 35
50  CONTINUE
    X(1)=I-2
    Y(1)=I-2
55  CONTINUE
    K=I-1
    DO 60 L=2,K
    Y(L)=Y(L)+B(3,N)*(ALOG(X(L)*100.))**2
60  CONTINUE
C
C  GENERAL CUSHION MATERIAL MODEL
C
    SRDH=SGRI(DHT)
    TR=(TEN+400.)/100.
    TR2=TR*TR
    TR3=TR*TR2
    TR4=TR*TR3
    ICOH= THCK**(-0.5)
    ICTH= THCK**(-1.5)
C
    DO 200 I=2,K
    S=X(I)*100.
    AL=ALOG(S)
    AL2=AL*AL
    V(1)=TR*ICOH
    V(2)=TR*ICOH*AL
    V(3)=TR*ICOH*AL2
    V(4)=TR*ICTH*SRDH
    V(5)=TR*ICTH*SRDH*AL
    V(6)=TR*ICTH*SRDH*AL2
    V(7)=TR*ICOH*SRDH
    V(8)=TR*ICOH*SRDH*AL
    V(9)=TR*ICOH*SRDH*AL2
    V(10)=TR2*ICOH
    V(11)=TR2*ICOH*AL
    V(12)=TR2*ICOH*AL2
    V(13)=TR2*ICTH*SRDH
    V(14)=TR2*ICTH*SRDH*AL
    V(15)=TR2*ICTH*SRDH*AL2
    V(16)=TR2*ICOH*SRDH
    V(17)=TR2*ICOH*SRDH*AL
    V(18)=TR2*ICOH*SRDH*AL2
    V(19)=TR3*ICOH

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V(20)=IR3*TCOH*AL
V(21)=IR3*TCOH*AL2
V(22)=IR3*TCOH*SRDH
V(23)=IR3*TCOH*SRDH*AL
V(24)=IR3*TCOH*SRDH*AL2
V(25)=IR3*TCOH*SRDH
V(26)=IR3*TCOH*SRDH*AL
V(27)=IR3*TCOH*SRDH*AL2
V(28)=IR*TCOH
V(29)=IR*TCOH*AL
V(30)=IR*TCOH*AL2
V(31)=IR2*TCOH
V(32)=IR2*TCOH*AL
V(33)=IR2*TCOH*AL2
V(34)=IR3*TCOH
V(35)=IR3*TCOH*AL
V(36)=IR3*TCOH*AL2
V(37)=IR
V(38)=IR*AL
V(39)=IR*AL2
V(40)=IR2
V(41)=IR2*AL
V(42)=IR2*AL2
V(43)=IR3
V(44)=IR3*AL
V(45)=IR3*AL2
YM(I)=CO
C
DO 150 J=1,NV
150  YM(I)=YM(I)+COLFF(J)*V(J)
200  CONTINUE
C
C    CALCULATE PREDICTION LIMITS
C
NPTA=X(1)
CALL CONFUN(X,Y,NPTA,YL,YU,B,YPL,YPU)
C
C    FIND MINIMUM IDCC G-LEVEL
C
YMIN=1000.0
DO 210 I=2,K
IF(YMIN .LE. Y(I)) GOTO 210
YMIN= Y(I)
M=I
210  CONTINUE
C
C    DETERMINE VALID MODEL RANGE FROM BOUNDED IDCC
C    AND PREDICTION LIMITS.
C
XMIN=X(M)
AL=XMIN-RANGE
AU=XMIN+RANGE

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      WRITE(6,901)
      WRITE(6,902)
      DO 250 I=2,K
      N=3H
      IB=3H
      IF(X(I) .GT. XL .AND. X(I) .LE. XU) IB=3H **
      IF( YPL(I) .GT. YM(I) .OR. YPU(I) .LT. YM(I) ) N=3H *
      IF(YPL(I) .LE. 0.0) GOTO 250
      WRITE(6,903) X(I),Y(I),YPL(I),IB,YM(I),N,YPU(I),YL(I),YU(I)
      GOTO 250
C      NEGATIVE G-VALUES SET TO - - .
230    WRITE(6,904) X(I),Y(I),      IB,YM(I),N,YPU(I),YL(I),YU(I)
250    CONTINUE
C
C      NEXT CASE
      GOTO 10
C
C      END OF JOB
800    WRITE(6,920)
      CALL EXIT
C
889    FORMAT(2F5.1,F7.1)
890    FORMAT(I2)
891    FORMAT(I1,2A6)
892    FORMAT(4X,10A6)
893    FORMAT(1H1,/,145,2A6,2X,'MODEL')
894    FORMAT(///,22X,'U',F15.8)
895    FORMAT(18X,I5,F15.8,5X,10A6)
899    FORMAT(1H1,10X,2A6,4X,F4.1,' IN. D.H. ',F7.1,' IN. THICK',
* F6.1,' TEMPERATURE')
900    FORMAT( )
901    FORMAT(///16X,'STATIC STRESS',17X,'DECELERATION (G)')
902    FORMAT(21X,'PSI',12X,'IDCC' ,4X,'LOWER-P',9X,'MODEL',6X,
1'UPPER-P',198,'LOWER-C',1X,'UPPER-C')
903    FORMAT(18XF6.2,9X,F7.2,4X,F7.2,4X,A3,F7.2,A3,3X,F7.2,T98,F7.2,
1 F7.2,4X,F7.2)
904    FORMAT(18XF6.2,9X,F7.2,7X,'- -',5X,A3,F7.2,A3,3X,F7.2,T98,F7.2,
1 F7.2,4X,F7.2)
920    FORMAT(1H1,'      END OF JOB')
      END

```

```

SUBROUTINE CONFID (X,Y,NPTS,YL,YU,B)
DIMENSION X(1), Y(1), YU(1), YL(1), B(5,4)
DIMENSION YPU(1), YPL(1)
DIMENSION XAR(500,3), YAR(500), C(3), A(3,3), XIN(3,3), E(3)
IAH=1.96
BX=0.0
YS=0.0
NPTS=X(1)
DO 100 I=1,3
  C(1)=0.0
  E(1)=0.0
DO 90 L=1,3
  XIN(1,L)=0.0
  A(1,L)=0.0
90 CONTINUE
DO 95 J=1,NPTS
  XAR(J,1)=0.0
  YAR(J)=0.0
95 CONTINUE
100 CONTINUE
F=0.0
S=0.0
SSQ=0.0
DO 10 I=1,NPTS
  J=I+1
  XAR(I,1)=1.0
  XAR(I,2)=ALOG(X(J)*100.)
  XAR(I,3)=XAR(I,2)**2
  YAR(I)=Y(J)
10 CONTINUE
DO 30 I=1,3
DO 20 J=1,NPTS
  C(1)=C(I) + XAR(J,1)*YAR(J)
20 CONTINUE
BX=BX+C(1)*B(I,2)
30 CONTINUE
DO 40 J=1,NPTS
  YS=YS+YAR(J)**2
40 CONTINUE
SSQ=(YS-BX)/(X(1)-3.0)
S= SQRT(SSQ)
DO 50 J=1,NPTS
  A(1,1)=A(1,1)+XAR(J,1)*XAR(J,1)
  A(1,2)=A(1,2)+XAR(J,1)*XAR(J,2)
  A(1,3)=A(1,3)+XAR(J,1)*XAR(J,3)
  A(2,1)=A(2,1)+XAR(J,2)*XAR(J,1)
  A(2,2)=A(2,2)+XAR(J,2)*XAR(J,2)
  A(2,3)=A(2,3)+XAR(J,2)*XAR(J,3)
  A(3,1)=A(3,1)+XAR(J,3)*XAR(J,1)
  A(3,2)=A(3,2)+XAR(J,3)*XAR(J,2)
  A(3,3)=A(3,3)+XAR(J,3)*XAR(J,3)
50 CONTINUE

```

```

      U=A(1,1)*(A(2,2)*A(3,3)-A(3,2)*A(2,3))+A(1,2)*(A(3,1)*A(2,3)-A(2,1
1)*A(3,3))+A(1,3)*(A(2,1)*A(3,2)-A(3,1)*A(2,2))
      XIN(1,1)=(A(2,2)*A(3,3)-A(3,2)*A(2,3))/D
      XIN(1,2)=(A(3,2)*A(1,3)-A(1,2)*A(3,3))/D
      XIN(1,3)=(A(1,2)*A(2,3)-A(2,2)*A(1,3))/D
      XIN(2,1)=(A(3,1)*A(2,3)-A(2,1)*A(3,3))/D
      XIN(2,2)=(A(1,1)*A(3,3)-A(3,1)*A(1,3))/D
      XIN(2,3)=(A(2,1)*A(1,3)-A(1,1)*A(2,3))/D
      XIN(3,1)=(A(2,1)*A(3,2)-A(3,1)*A(2,2))/D
      XIN(3,2)=(A(3,1)*A(1,2)-A(1,1)*A(3,2))/D
      XIN(3,3)=(A(1,1)*A(2,2)-A(2,1)*A(1,2))/D
      RETURN
      ENTRY CONFUN(X,Y,NPTS,YL,YU,B,YPL,YPU)
      DO 45 I=1,NPTS
      XAR(I,1)=1.
      U=1+1
      XAR(I,2)=X(U)
      XAR(I,3)=XAR(I,2)**2
45    CONTINUE
      IU(1)=NPTS
      YL(1)=NPTS
      YPL(1)=NPTS
      YPU(1)=NPTS
      DO 80 U=1,NPTS
      DO 70 I=1,3
      DO 60 K=1,3
      L(1)=E(I) + XAR(U,K)*XIN(K,1)
60    CONTINUE
70    CONTINUE
      DO 72 I=1,3
      F=F+E(I)*XAR(U,I)
72    CONTINUE
      F2=1.0+F
      F2=SQRT(F2)
      F=SQRT(F)
      N=U+1
      IU(N)=Y(N)+TAH*S*F
      YL(N)=Y(N)-TAH*S*F
      YPU(N)=Y(N)+TAH*S*F2
      YPL(N)=Y(N)-TAH*S*F2
      F=0.0
      DO 75 I=1,3
      L(1)=0.0
75    CONTINUE
80    CONTINUE
      RETURN
      END

```